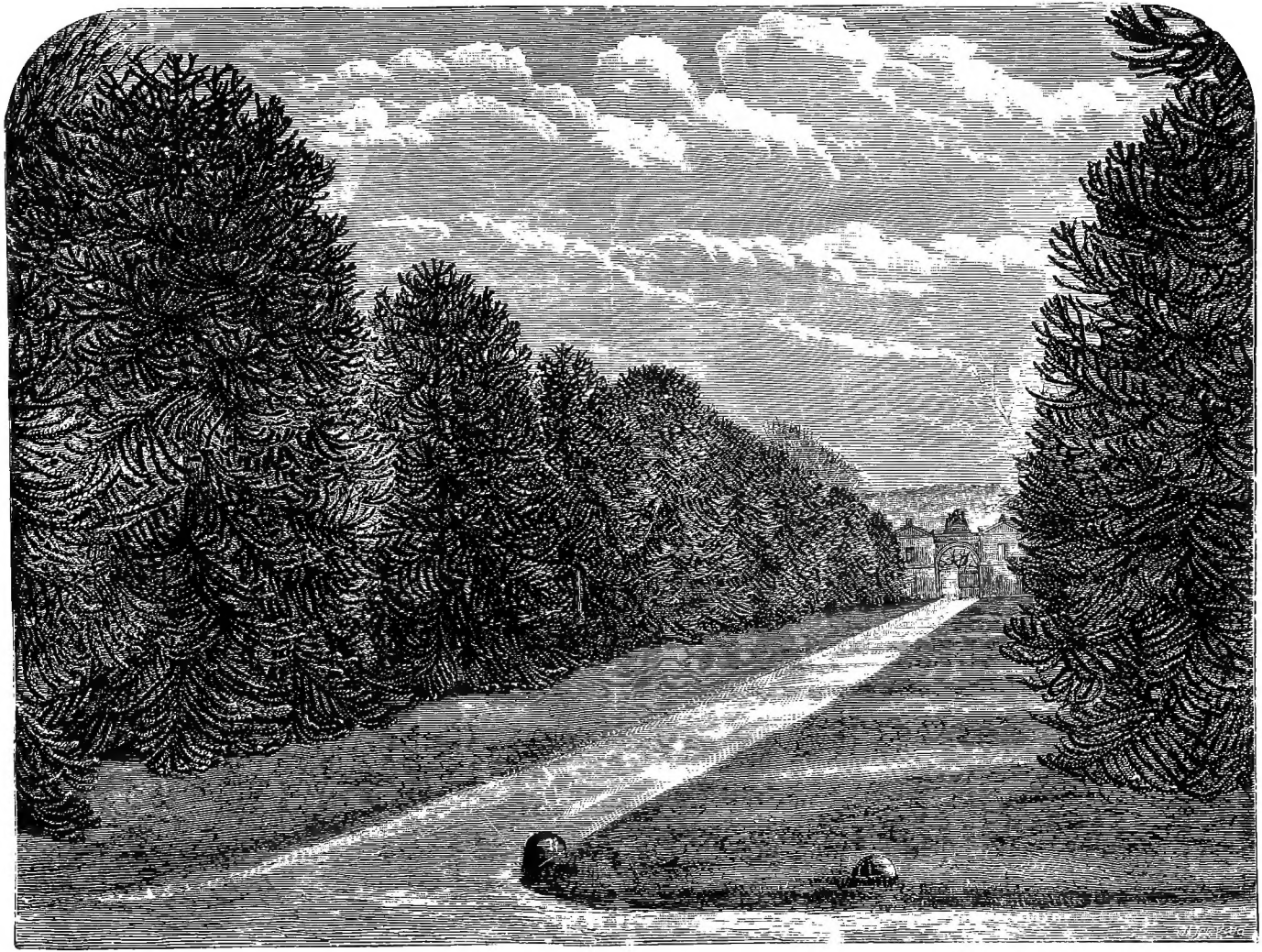
A MANUAL OF THE CONIFERÆ.



The Araucaria Avenue at Bicton. *See* page 194.

A MANUAL

OF

THE CONIFERÆ,

CONTAINING

A GENERAL REVIEW OF THE ORDER; A SYNOPSIS OF THE HARDY KINDS CULTIVATED IN GREAT BRITAIN; THEIR PLACE AND USE IN HORTICULTURE, ETC., ETC.

WITH NUMEROUS WOODCUTS AND ILLUSTRATIONS.

JAMES VEITCH & SONS,

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Text very inaccurate, but
illustrations may be of some value.
G. F. S.

INTRODUCTION.

THE present Manual is founded upon a useful little book prepared many years ago by our predecessors, Messrs. Knight & Perry, of these Nurseries, but which has long since been out of print. It has been compiled to supply the demand for *practical* information respecting Coniferæ which we are constantly receiving from correspondents, and which is not contained in scientific works on the subject, or is but cursorily touched upon in them.

Messrs. Knight & Perry's book contained a synopsis of all the Coniferous plants grown in Great Britain at the time of its publication, and of which they had formed a collection. We have adhered to the general plan of their work, but the progress that has been made in every department of horticulture since that period, in which the culture of Coniferous plants has, in a great measure, participated, and notably the numerous acquisitions of new species and varieties, many of which we ourselves have been instrumental in introducing, have necessitated the re-writing of the whole, not only for the purpose of embodying the most important facts since accumulated from many sources, but also for revising the descriptions of the species and varieties which were then but imperfectly known.

Our endeavour has been to treat the subject in a manner as *popular* as possible, so as to render the Manual acceptable to every class. While avoiding technical terms, as far as it could be done, consistent

with a clear explanation of the subject, we have omitted no important matter of which we have any cognisance, whether of a practical bearing or of scientific interest.

The plan adopted in the following pages may be thus stated:—

Part I. is a General Review of the Coniferous Order. It contains a brief description of the structure of Coniferous wood, the organs of vegetation and fructification, the secretions, economic properties, diseases, and accidents; the distribution of the Coniferæ over the globe; and lastly, the scientific arrangement and nomenclature, as given by the most eminent botanists, who have studied the Order.

Part II. contains a Synopsis of Genera, species and varieties suitable for cultivation in Great Britain. It corresponds in form to the original Synopsis of Knight and Perry.

Part III. contains lists of the species and varieties suitable for the different purposes for which Coniferæ are planted, with some hints as to their treatment, &c.

The arrangement adopted in Part II. has been especially framed with regard to practical convenience rather than in strict conformity with the scientific Divisions and Sub-divisions of the Order given in Part I., although these have been kept constantly in view throughout. Genera and species, whose habitat is tropical or sub-tropical, and which will not therefore stand the severity of our winters without protection, and others unsuitable for ornamental or landscape planting, or of no economic value, are but very briefly noticed. The former are omitted altogether from the Synoptic tables of the Genera that precede the descriptions of their contained species and varieties.

The first column in these tables contains the scientific names under which the trees are described; these names are, in all cases, those which appear to us to be sanctioned by the greatest weight of authority, and they are also, in most instances, those generally adopted in this country. In the second column are inserted the synonyms still in use, with the names of their authors; obsolete synonyms are purposely omitted. The third column contains the popular name of each tree or shrub, where a recognised one exists; in other cases, the scientific name is expressed in its equivalent English. The habitat given in the next column is referred to the most important or best known country or locality of which the tree or shrub is native; in the popular descriptions following, the habitat is more precisely stated. The height in feet in the last column is approximately that attained by the tree in

its native home. The order is alphabetical for greater convenience of reference.

There exists much diversity of opinion as to the precise limits of the Coniferous genera, some authorities raising to the rank of genus, kinds which others regard as species of some more widely defined type.* Specific characters are in many cases still more vaguely framed, so that the species of some authors are by others considered to be varieties of some more common form.† Into any discussion of controverted subjects like these it is not our province to enter. It is sufficient, therefore, to state once for all, that the names given as specific, and under which the trees and shrubs in Part II. are described, are the names of kinds which, for Arboricultural and Horticultural purposes, are sufficiently distinct to require special notice, and without in any way indicating our belief or disbelief that they are species, in the ordinary acceptation of the term, or not. We have not, however, hesitated to quote authorities, whose opinions are entitled to respect, on a few controverted points which have arisen, and which could not be passed over in silence.

In the descriptions of the trees and shrubs, many botanical details are omitted; for these the reader must consult the more elaborate works especially devoted to the subject; but, we trust, enough is given to convey a clear idea of the plants described, and even sufficient in most cases to enable them to be identified. To the description of each of the most important trees is added the date of its introduction into Britain, where it can be ascertained; also information respecting the economic properties and the purposes for which it is employed.

We have derived much valuable information from existing Pineta. Foremost among these we may mention that of the Right Hon. Lady Rolle, whose magnificent collection at Bicton stands unrivalled in this country. We must also name those of the Right Hon. Earl Ducie, at Tortworth; the Right Hon. Viscount Holmesdale, at

* Abies, Cedrus, and Larix are brought by some authorities under Pinus; Wellingtonia under Sequoia; Chamæcyparis and Retinospora under Cupressus; Biota and Thuiopsis under Thuia, &c.

† *Cedrus deodara*, *C. atlantica*, and *C. Libani* are regarded by eminent authorities as only forms of *one* species. *Pinus austriaca* and *P. Pallasiana* are described by Parlatore as varieties of *P. Laricio*. *Abies Cephalonica* is considered by the same botanist to be only a variety of *A. pectinata*; and many other instances might be cited. It must, however, be admitted that the difficulty of framing specific characters is often very great, and that a divergence of opinion among botanists as to the relative specific value of any character, or combination of characters, would seem to be almost inevitable.

Linton Park; T. Gambier Parry, Esq., at Highnam Court, Gloucester; W. Parker Hamond, Esq., at Pampesford Hall, Cambridge; His Grace the Duke of Devonshire, at Chatsworth; the Right Hon. the Earl of Harrington, at Elvaston Castle; the Right Hon. Lord Windsor, at Hewell Grange, Bromsgrove; J. D. Bassett, Esq., at Leighton Buzzard; Robert Barclay, Esq., at Berry Hill, Dorking; C. J. Freake, Esq., at Bank Grove, Kingston Hill; and C. D. Fortescue, Esq., at Dropmore.

Text very inaccurate, but illustrations may be of some value
G. F. S.

PART I.

GENERAL REVIEW

OF

CONIFEROUS PLANTS.

CONIFERÆ, or Cone bearing, is the name given to a Natural Order of Plants consisting of trees and shrubs represented in nearly all parts of the world where arborescent vegetation exists,* and distinguished from every other Order of Plants by certain characters or properties, by the presence of any of which Coniferous plants may be readily recognised. The most noteworthy of these characters are to be found in the internal structure of their wood or stems, the resinous nature of their secretions, the extreme simplicity of their flowers, and their fruit. The foliage and fruit, together with the physical aspect of the plant or tree, or its general appearance as presented to the eye, are the most easily observed; they are therefore, except by the Botanist, almost the only characters by which Horticulturists and others recognise Coniferous plants.

The Fruit of the Fir and Pine tribe, which slightly resembles a cone, doubtless suggested the name Coniferæ as a suitable designation for the Order, but the name has not been universally accepted.

* Hindostan is an exception. Sir J. D. Hooker observes, that "It is a very remarkable fact that no Gymnospermous tree inhabits the peninsula of India, not even the genus Podocarpus, which includes most of the tropical Gymnospermæ, and technically Coniferous, and has glandular woody fibre, though, like the Yew, it bears berries."—*Himalayan Journals*, vol. ii., p. 282. Central Africa is also a probable exception, but even there the curious and anomalous *Welwitschia mirabilis* has its home.

Following the rule observed in designating other Natural Orders, the selecting of one of the contained genera as a type to which the others may be referred, the name Pinaceæ has been used by some authors in preference to Coniferæ.* It may be observed, however, that if the name Coniferæ as applied to the Order, on account of the form of the fruit borne by some of the most important species belonging to it, is open to some objection, the mode of growth of by far the greater number of the species, especially in their young state, is strictly that of a Cone in outline. The German name, *Nadelhölzer*, is expressive as regards the Fir and Pine tribe and some others, but is scarcely applicable to the whole Order.

Structure of Coniferous Wood.—Microscopic investigations of the tissues and minute parts of plants by men of science show, that while the anatomical structure of Coniferous wood resembles that of the broad-leaved (dicotyledonous) trees and shrubs in all essential particulars, there are revealed in its organisation peculiarities not found in the wood of trees belonging to any non-Gymnospermous Order, and by which Coniferous wood may be distinguished from every other kind. These peculiarities in structure also afford data for the identification of Coniferous wood in the fossil state, and its presence in that state in the coal strata proves, not only that it enters into the composition of that important mineral, but also the existence of a Coniferous vegetation at an early period in the Earth's History.† They will be best understood from an examination of the general structure of the stem of any one of our native trees not Coniferous and comparing it with that of one that belongs to the Order.

A small branch, the structure of which is identical with that of the main stem or trunk, may be taken for examination, and one that has completed at least three years' growth will be the best for the purpose. A cross section of this should be made with a sharp knife, so that the surface made by the cut may be sufficiently smooth for the markings that will be found on it to be distinctly seen. A very

* Lindley, *Vegetable Kingdom*, p. 226. *Pinaceæ*, being a Handbook of the Firs and Pines, by "Senilis." 1866.

† "That Coal is little else than mineralised vegetable matter is a point on which there has been for a long time but small doubt. The more minute investigations of recent years have not only placed this completely beyond question, but have also enabled men of science to say what the plants were which contributed to the formation of Coal, and in some cases even to decide what portions of the plants enter into the composition." "*Coal*," by the Professors of the Yorkshire College, p. 16.

cursory examination of the section shows the following arrangement of the parts: 1st—A central pith, which is larger or smaller according to the kind of tree or shrub to which the branch belongs, large in the Elder, smaller in the Sycamore, a mere point in the Oak; and also according to the age of the stem; it is always enveloped in a delicate network of vessels termed the medullary sheath. 2nd—Around the pith will be seen a series of rings or concentric circles, the number of such rings corresponding precisely with the age in years of the stem examined. 3rd—These rings are crossed by lines generally of a lighter colour, all radiating from the central pith, and known by the name of medullary rays. 4th—The whole is surrounded by, and enclosed in, a cuticle or covering familiarly called the bark.

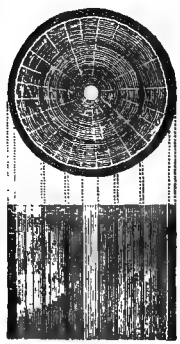


Fig. 1. Transverse and longitudinal sections of a three years old stem.

This form of structure is the result of the mode of growth of the tree or shrub. The pith is the remains of the cellular or soft tissue of the tender stem first produced from the seed in the primary shoot and its prolongation during its successive annual growths, or from a leaf bud in a lateral one. The concentric rings are the woody fibrous tissues with the spiral and other vessels which lie next the centre, and are the parts first formed by the growth of each succeeding year; the medullary rays are, as it were, the channels of communication during the circulation of the sap; first, between the central pith and the bark surrounding the first ring of woody fibre during its formation, next between the first ring and the bark during the formation of the second ring, and so on, the central portion becoming hardened, and the channels obliterated by the gradual deposition of the inorganic matter which is always contained in the fluid absorbed or sucked up by the roots. As such a stem increases in size by successive layers from without, the bark being as it were pressed outwards to admit of the successive yearly addition of rings, it is technically called an Exogen.

The stem or branch of a Coniferous tree shows the same general structure as that we have just described. The medullary rays are, however, generally much fainter, and often quite inconspicuous, but they are nevertheless present; there are also differences and modifications in the minute parts, which we will now point out.

The woody fibrous tissues contained in the rings that surround the central pith in the stems and branches of the broad-leaved and deciduous trees, and in fact in nearly all Exogenous stems when first formed, are usually minute elongated tubes joined together into a continuous thread. Examined by means of the microscope, these minute fibres are found to be elongated transparent cells, with membranous walls, tapering to a

point at each end. The spiral vessels much resemble the woody fibrous cells, but with their membranous walls much thinner, and "enclosing a spiral fibre coiling more or less regularly within its thin tube from one extremity to the other."* These spiral coils are now known to contain air, and play an important part in the functions of the plant, especially in connection with the transmission of the sap; they are found in the leaf-stalks of most of our large trees, as the Lime, Maple, &c.

Now the minute parts of the stem of a Coniferous tree, as the Pine or Fir, are found to differ from those of other trees in the following particulars—

1. The tubes have a diameter much greater than that of the wood cells of any other class of Exogenous trees.

2. They alone transmit the sap upwards,† which is very abundant.

3. There are in general no true vessels; rows of vascular cells, which occur only in the medullary sheath, taking their place.‡

4. There are marked on the sides of the tapering wood cells, towards the medullary rays, a peculiar set of dots or circular disks.

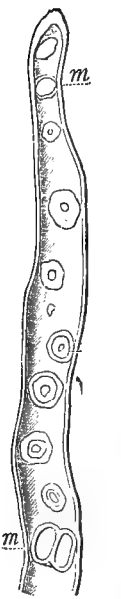


Fig. 2. Wood cell of Scotch Fir, with bordered pits; *m m* pores connecting the cells of the wood with those of the medullary rays. × about 250. Copied from Thomé.

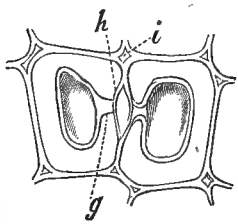


Fig. 3. Transverse section of two wood cells of Scotch Fir, each with a pore, "*g*" widened at the base. By the disappearance of the original cell walls, the two widenings have united to form the "border" *h*, *i*, intercellular spaces. × about 400. Copied from Thomé.

These dots were supposed to be minute glands between the adjacent tubes or cells, and the woody fibre in which they were found was called the glandular form of that fibre. But recent investigations have shown that their presence is owing to the want of uniformity in the increase in the thickness of the cell walls, and that at certain spots, pitted or cell pores are formed, the membrane between the cells disappearing, and the cells becoming actually perforated. In Coniferous wood these pore cells are widened at their base, rendering them comparatively easy to be detected under the microscope. They are called "bordered pits." *See* Figs. 2 and 3. "The characteristic position of the pits which, in the cells of the stems, are usually arranged in one; in those of the roots, often in several rows, as well as that of the resin passages, form an excellent diagnosis to distinguish the different kinds of wood."§

* Dr. Carpenter, *Vegetable Physiology*, § 53.
† *Idem*, § 51.
‡ Thomé's *Structural Botany*, p. 371.
§ *Idem*, p. 372.

We now proceed to note the most evident characteristics of Coniferous plants in their external aspect, including the parts buried in the soil.

Roots.—The Roots of Coniferous plants are produced freely from the very first starting of the germ into active growth; they do not descend straight down into the soil like a tap root, but soon begin to spread horizontally near the surface.* At first but slender fibrous threads, ramifying at very short intervals and sub-dividing repeatedly, they form a network spread over a circular area, which in all the kinds cultivated in this country is generally greater than the spread of branches of the stem. As the plant increases in age the primary roots increase in diameter "simultaneously with the stem, and under the influence of exactly the same causes," † and spreading, as they do under all ordinary circumstances, on all sides of the tree, they not only form a broad base for the support of the superincumbent mass of stem and branches, but they are also exceedingly tough in texture, and cling tenaciously to the soil through which they penetrate and to the rocks over which they creep. Hence it is that Coniferous trees are so well enabled to withstand the force of high winds without being blown down. The rootlets are exceedingly numerous, so that their terminal spongelets must possess an enormous absorbent power, a power evidently necessary to the well-being of the tree on account of the comparatively large diameter of the tubes through which the sap flows, and which, while the tree is in active growth, are not only always full, but the sap is also in motion. Like other Exogenous trees, the roots of Coniferæ have, at least in temperate climates, a period of comparative if not absolute repose, during which, except in frosty weather, the plant may be taken out of the ground and removed to another spot, even after it has attained a considerable size.‡ The vitality of the roots of Coniferous plants is remarkable, especially in the Fir and Pine tribe. Many instances have been observed of which the roots not only live but continue to grow for many years after the trunk has been cut down.

The foregoing characters are, generally speaking, common throughout

* The primary radicle is, of course, an exception; but this is too minute to affect the general statement.

† Dr. Lindley, *Theory and Practice of Horticulture*, p. 21.

‡ It is not, however, advisable to remove large trees, especially of the Fir and Pine tribe, whose roots extend far from the trunk, and which cannot even with the greatest care be removed without destroying and injuring a large proportion of the rootlets.

the Order, but a few peculiarities that are met with in the different tribes require separate notice.

In many of the species belonging to the Cypress tribe (Cupressineæ), and which are mostly of fastigiate or strict habit, the primary roots lengthen but slowly, although they increase in thickness considerably during the first years of the life of the tree; but the rootlets form a dense plexus, occupying a circular area not much greater than the spread of the branches above. It is not till the tree has acquired some age, and the soil in immediate proximity to it has become quite exhausted, that the roots lengthen to any considerable extent in search of nutriment, which they do in conformity with a law universal throughout the Vegetable Kingdom. The fibrous rootlets then become more spreading; those formed during the earlier life of the tree having fulfilled their functions, die.

In the Yew the plexus of fibrous rootlets is always very great even at an advanced age of the tree, so that the absorbent power of the roots of a large Yew must be enormous. There can be no doubt that this is one of the causes that contribute to the longevity of the Yew; and it is probable, too, that these rootlets have a limited power of selection in the substances taken up by them, since the Yew will live and thrive in soils of the most opposite description and maintain a tolerably constant habit and colour of foliage everywhere.

In the Sequoia tribe (Taxodiæ) all the principal members of which are not only among the largest of Conifers, but also among the largest of trees, the roots lengthen very rapidly from early life, and spread over a large area always near the surface. A striking peculiarity is seen in the roots of the deciduous Cypress (*Taxodium distichum*) when this tree attains its maturity and is growing in swampy places, as it most commonly does in its native forests in North America, or in close proximity to water in England; they form hollow conical or beehive-shaped protuberances that rise several inches above the surface of the ground, and which have never been noticed to produce buds from which shoots proceed; these protuberances are popularly called "knees."* The deciduous Cypress will also send its roots deep down through water and fix them into the soil beneath.

Although under ordinary circumstances the roots of Coniferous plants spread equally from all sides of the stem, they will, as in other plants, develop in one direction more than in another when the nutriment suitable for the support of the tree is present only on one side, or is more abundant on one side than on others, or if they are prevented by obstacles from extending equally on all sides;† they will also grow downwards to a considerable depth under similar influences.

* *See* the article on *Taxodium distichum* in Part II, with the engraving of the tree with "knees," at Syon House.

† *See* some remarkable instances of the rooting of the Spruce Fir in London. *Arb. et Frut.*, p. 2298.

The power of forming roots by pieces detached from the parent plant, or by "cuttings," is very considerable, but differs much in the different tribes. It appears to exist nearly in the same ratio as that of producing leaf buds; thus in the Cypress tribe, in which the branchlets ramify repeatedly and produce lateral shoots very freely when the leaders are, in garden phraseology, "headed back," cuttings take root very readily when placed in circumstances favourable for their development. In the Sequoia and Yew tribes the power of rooting from cuttings is almost as great as in the Cypress and its allies. It is much weaker in the Fir and Pine tribe; some of the Araucarias possess it in a high degree; the Spruce and Hemlock Firs less so; it is feeble in the Silver Firs, and wanting, or nearly so, altogether in the true Pines.

Stems.—The STEMS of Coniferous plants, the internal structure of which we have just described, are Exogenous and ligneous or woody in texture; they attain generally a timber-like size, and consist of a heart-wood, the older growth, which in many species is very durable, and affords valuable wood for economic purposes; and a sap-wood, the later growth, which soon decays on exposure to the weather; the whole being enclosed in a tegument or bark similar in structure in all its essential parts to that of other Exogenous trees, but showing in some of the species some peculiarities. With very few exceptions the stems or trunks of Coniferous trees are cylindrical and tapering, growing perfectly erect, and attaining dimensions varying from a few inches* to upwards of 300 feet in height,† and with diameters generally small in proportion to the height, but in this respect the Yew, the Cedar of Lebanon, and the deciduous Cypress are well known exceptions. The size attained by stems of the same species is far from being uniform except under like conditions, the growth being greatly influenced by soil, situation, or climate, or by a combination of these causes. Some species of Pinus and Abies, for example, having the slopes of mountains for their habitat, near the base grow from 60 to 100 feet high, or even more; but this height is found to diminish in proportion to the elevation at which they grow, so that at the highest point, often at the limits of perpetual snow, they are dwarfed to a more scrubby bush over which a man may step. A similar change is observed in species whose habitat extends over many degrees of latitude; thus, the Cembra Pine on the Swiss Alps, and under cultivation in our

* *Juniperus communis compressa*, native of the Pyrenees.
† *Wellingtonia gigantea*, the Mammoth tree of California.

own country, grows from 50 to 70 feet high; at its northern limit, in the Siberian Plains and Kamtschatka, it is dwarfed to a low bush whose height ranges between 50 and 70 inches. The American White Spruce (*Abies alba*), which in Canada and the adjoining States, at about lat. 45° N., attains a height of 50 feet; at its northern limit, approaching the shores of the Arctic Ocean, at 65°, its height is less than 50 inches. *Pinus Banksiana,* which is scarcely botanically distinct from the Scotch Pine of our own country often seen upwards of 100 feet high, is a straggling shrub of from three to five feet high among the rocks in the dreary wastes of Labrador.

The chief cause of the great difference just noticed is the diminished amount of solar heat which the dwarfed forms receive, and by which their growth is constantly retarded. At high elevations, this diminution is owing to the rarity of the atmosphere, which permits a rapid radiation of heat into space without affording any such checks as are present in the denser strata of lower altitudes and at the sea level, where the atmosphere is always more or less surcharged with vapour. In high latitudes, the diminution of solar heat is due to the slanting direction in which the sun's rays strike the earth, owing to the convexity of its surface, and whence their power is greatly weakened; also the short period the sun is daily above the horizon during nearly half the year, owing to the obliquity of the earth's axis.

The size and height attained by the trunks or stems of Coniferous trees, and more especially of the same or allied species, are also greatly influenced by the amount of moisture of the climate in which the trees are growing, or which amounts to nearly the same thing, the annual rainfall of the region or district. It is observed, in reference to the distribution of the Coniferæ, that their abundance and rate of growth follow pretty nearly the general laws relative to the distribution of rain:—thus (1).—In the mountainous regions of the temperate zones more rain falls than in the level districts, because mountains arrest the clouds, and a condensation of vapour ensues from collision with their cold summits, and there are found the densest forests and most luxuriant growth. (2).—The precipitation of rain decreases in proceeding from the Tropic of Cancer to the Arctic Circle; in like manner it may be roughly stated that, except in maritime districts, the size attained by Coniferous trees and their rate of growth diminish in a like ratio. (3).—The rainfall also decreases in passing from maritime to inland countries; it is also found that the growth of Coniferous plants is influenced by the same law. The same general facts are observable in England: thus in Cornwall and Devonshire the average annual rainfall exceeds 30 inches, while in the Eastern Counties it is often below 20 inches. The numerous reports published in the horticultural journals during the

past twenty-five years, show that the rate of growth of Conifers in the south-west and west of England is much greater than in the Eastern Counties And so in Scotland. On the west coast, the annual rainfall reaches 40 inches, in particular spots very much more, while on the east side of the country, it is not more than 25 inches.* The finest Coniferæ in Scotland are found where the temperature and rainfall are highest.

In further illustration of these laws, the following are well-attested instances. The mountain ranges in the North American Continent in the neighbourhood of the Pacific Ocean, extending through California, Oregon, and British Columbia, are covered with the densest coating of Coniferous vegetation known, and there the temperature during the summer is high and the rainfall copious. In the eastern parts of the Continent, where it is much drier and colder, the Weymouth Pine (*Pinus Strobus*) attains a height of 100 feet; in nearly the same latitude, near the Pacific Coast, its close ally, the Sugar Pine (*Pinus Lambertiana*), towers to nearly three times that height. The Balsam Firs of Canada and Carolina (*Abies balsamea* and *A. Fraseri*), are low short-lived trees, not often more than 40 feet high; their congeners, the Western Balsam Firs of California and Oregon (*A. grandis* and *A. concolor*) are giants 200 feet high, and live for centuries. In the humid climate of the Himalayas, the Deodar Cedar, Hemlock Fir (*Abies Brunoniana*), and some of the Junipers attain dimensions far exceeding those of their nearest allies in other parts of the Eastern Continent. In Europe, all the principal mountain ranges abound in Coniferous forests, affording valuable timber; while in the plains, where the rainfall is much less, many kinds are dwarfed, and others cannot be made to thrive even under cultivation. Under the tropical rains of Mexico, the deciduous Cypress rivals in size its great Californian cousins, while further north in the United States, it is a moderate sized tree, 120 feet high or thereabouts.

The stems or trunks of the larger Coniferous trees increase in height and diameter very rapidly after the first years of their "infancy," when the plant has become established. Thus the Wellingtonia in this country grows at the rate of from 24 to 30 inches in one year, and *Thuia gigantea* and *Cupressus macrocarpa* have been known to make an addition of nearly four feet to their height in one season. *Abies Nordmanniana* and *A. nobilis*, which commence their growth late in the season, will add to their leaders from 15 to 18 inches in the short space of six or eight weeks. *Abies Douglasii* makes an average growth of from 21 to 27 inches annually, and *Pinus insignis*† even more. The rate of growth varies in each

* See *Physical Geography of Great Britain*, by Dr. Ramsay, Fourth Ed., p. 197-200.

† The growth of *Pinus insignis* in the warm and more equable climate of New Zealand is very rapid. A correspondent in the Canterbury district recently informed us that he had measured shoots of the preceding year's growth 9 feet long; the average growth of a number of trees in a plantation was quite 6 feet.

kind according to the soil and situation, it is also influenced by the state of the season, being greater or less according as the temperature is higher or lower than the average mean.

The following known physiological conditions go a great way towards explaining the cause of this rapid increase in the stems of Coniferous trees. The tubes and channels through which the sap circulates have, comparatively, a greater diameter than those of most other trees; they therefore admit of and even require an abundant supply of fluid to fill them; they obtain this supply by means of the roots, which possess an enormous absorbent power. These roots, it must be remembered, are generally near the surface, so that as soon as the warm days of spring and summer begin to put the sap in motion in the terminal branchlets and parts most exposed to the sun's influence, and also to raise the temperature of the soil sufficiently to excite the rootlets into action, which in most of the species is very energetic, and produces a corresponding rapidity in the circulation of the sap and the formation of new tissues,* the growth of the tree proceeds apace, the stem not only increases in height but also in diameter. The deposition of the insoluble matters taken up by the roots, soon choke up the older channels of circulation, and the successive annual layers or rings pressing closely around those previously formed, the trunk becomes consolidated. Some of the members of the Fir and Pine tribe, and notably the gigantic Sequoias of California and the Common Yew continue to grow for centuries, adding yearly ring after ring to the circumference of their stems, building up vast pillars of wood that are the wonder of all who behold them.

Theoretically, the trunks of Coniferous trees, like other Exogenous stems, might increase in size and height indefinitely, were there no counteracting causes at work to check and finally to arrest the progress; but such sooner or later are sure to arise, and among the, principal is undoubtedly the gradual exhaustion of the soil in which the tree is growing. The functions of the various organs become enfeebled by age, as they do in the animal frame, although the period of the life of the one is in most instances immensely prolonged compared with that of the other, so that the cause of decay is so much the slower in its action. The vigour with which Coniferous trees increase in size during the earlier period of their existence is sensibly diminished in process of time, till at length the counteracting causes balance the growing power; the tree has then reached its full maturity; the period of decay sets in which is never permanently

* Every one who has made an incision through the bark of the Common Larch, the Spruce Fir, or the Scotch Pine, especially at any time during the growing season, is aware of the very rapid flow of sap from the wound. Advantage is taken of this rapid flow, to procure the turpentine of commerce from the species that yield it by making incision in the bark, and keeping the wound open.

arrested till the death of the individual and the subsequent decomposition of its tissues is complete.

A cross section of the trunk of a large coniferous tree shows that the annual rings nearest the central pith are the broadest, and that their width diminishes as they recede from the centre to the bark.* The diminution is not symmetrical, a ring of a certain width in any part of the section is not precisely so much narrower than the one within it, or so much broader than the one immediately without it. On the contrary, the irregularity in this respect is very considerable, so that a ring is often found which is broader than one nearer the centre.† This irregularity is believed to be due to climatal changes. During a long and warm summer a Coniferous tree will make much more growth than during a wet and comparatively cold one, and it is not improbable that the fluctuations in the seasons are represented by the different widths of the rings. The general principle is, however, never departed from; the rings more remote from the centre diminish in width as they approach the bark. In very aged trees the rings near the outside are so close together that they can only be counted with difficulty, upwards of one hundred of them scarcely occupying a breadth of more than from one to two inches.

The AGE attained by Coniferous trees varies very much in the different families. Some members of the Cypress tribe complete their evolution in a few years; the gigantic Sequoias of California have been living during the greater part of the time that separates us from the commencement of the Christian Era. Between these extreme cases are numerous examples of greater or less longevity; thus the Yew is known to live over a thousand years, while the American Balsam Fir rarely attains the "appointed age of man."

The following estimate, given by various authorities, of the ages attained by some of the largest Coniferous trees must be accepted only with a degree of reservation corresponding to the difficulty experienced in ascertaining anything like an approximation to the truth.

The Californian Big Tree *(Wellingtonia gigantea)*	from	1,500	to 2,000	years.
The Red Wood *(Sequoia sempervirens)* .	,,	1,300	,, 1,750	,,
The Yew *(Taxus baccata)* . . .	,,	1,100	,, 1,250	,,
Deciduous Cypress *(Taxodium distichum)* .	,,	750	,, 1,000	,,
Himalayan Cedar *(Cedrus Deodara)* .	,,	750	,, 900	,,
Cedar of Lebanon *(Cedrus Libani)* .	,,	600	,, 800	,,
Douglas Fir *(Abies Douglasii)* . .	,,	450	,, 600	,,

* The cross section of a large Wellingtonia felled in California for the purpose of ascertaining its age, showed the width of one hundred rings nearest the centre to be 13 inches, and that of one hundred rings nearest the bark to be 3 inches only.

† "The separate annual rings are not always of uniform thickness, but are often more strongly developed on one side than the other."—Thomé's *Structural Botany*, p. 365.

Silver Fir *(Abies pectinata)* .	. from	450	to	600	years.
Roman Cypress *(Cupressus sempervirens)* .	„	350	„	500	„
Sugar Pine *(Pinus Lambertiana)* .	„	350	„	500	„
Moreton Bay Pine *(Araucaria Bidwilli)* .	„	300	„	400	„

Coniferous Timber.—The timber yielded by the stems of Coniferous trees is of universal importance. It possesses qualities that render it exceedingly serviceable for building and other constructive purposes, as durability, strength, lightness, elasticity, fineness in grain, &c. It also abounds in quantity immensely in excess of that of any other Order of Trees, so that it is also the cheapest and most easily obtained. In the northern hemisphere, the timber used in building may be said to be almost exclusively Coniferous, obtained from the Fir and Pine tribe, and in populous countries as Great Britain, Holland, Belgium, &c., where it does not exist, or cannot be grown in quantity sufficient for the supply, and where natural forests have long since almost disappeared, it forms an important article of commerce.

The qualities of Coniferous timber vary much in the different tribes, and also among members of the same tribe. Thus the wood of the Roman Cypress *(Cupressus sempervirens)* is almost imperishable by the ordinary agents of decay except fire; that of the Canadian Hemlock Spruce decays rapidly on exposure to the weather; the wood of the Yew is among the hardest and most elastic known; that of the Californian Mammoth (Wellingtonia) is one of the softest and most brittle; the timber of the Weymouth Pine *(Pinus Strobus)* and Black Spruce *(Abies nigra)* is among the most valuable obtained from American trees, while their near allies, the New Jersey Pine *(Pinus inops)* and the Balsam Fir *(Abies balsamea)*, growing in the same region, are scarcely worth felling for fuel.

Some remarkable instances of the DURABILITY of the wood of some of the Coniferous trees have been recorded.

The gates of Constantinople, which were destroyed by the Turks in 1553, after having lasted eleven hundred years, were made of the wood of the European or Roman Cypress.

Mr. Moorcroft writes in his Journal (about fifty years ago), "A short time since a building, erected by the order of the Emperor Akbar (A.D. 1542—1605), was taken down, and its timber, which was that of the Deodar Cedar, was found so little impaired as to be fit to be employed in a house built by Rajah Shah; its age could not have been less than two hundred and twenty-five years.*

* Loudon, *Arb. et Frut.*, p. 2431.

In the *Toronto Globe*, of April 9, 1863, Mr. W. D. Ferris, writing from New Westminster, British Columbia, states that the trunk of a Douglas Fir, showing no signs of decay, had been discovered partially embedded in the earth long enough to allow a Hemlock Spruce to grow upon it which was fully one hundred and fifty years old.*

The doors of St. Peter's at Rome, which had lasted from the time of Constantine to that of Pope Eugene IV., about eleven hundred years, were of Cypress wood, and were found, when removed by Pope Eugene, to be perfectly sound.†

The elder Michaux, in his journey to Hudson's Bay, in 1792, found the church built there by the Jesuits still standing. This building was constructed with squared logs of the Arbor Vitæ, in 1728, as was proved by an inscription over the door, and it had remained perfectly sound more than sixty years.‡

The prostrate trunk of a *Podocarpus spicatus* was observed not long since in a valley near Dunedin, New Zealand, to be enfolded by the roots of three large trees of *Griselinea littoralis*, with trunks three and a half feet in diameter, which must have grown from seed since its fall. They were recently felled, and the growth rings count over 300, thus approximating three hundred years, during which the timber of the Podocarpus has remained so fresh and sound, that it has since been split into posts for fencing purposes.§

"The prostrate trunk of a Wellingtonia, with no signs of decay in any part of it, had been burnt in two by a forest fire. In the trench between the two portions a Silver Fir grew. This Fir was felled, and had 380 annual rings; therefore, to estimate the time during which the Sequoia trunk had lain uninjured, we must add to the three hundred and eighty years:—first, the time it lay before the forest fire burnt it, and then the unknown interval between that time and the arrival of the Silver Fir seed."‖

The STRENGTH of Coniferous timber has been tested by experiments. The following results, obtained by the late Mr. W. Wilson Saunders, and published in the *Gardeners' Chronicle* for 1862, p. 643, will serve for illustration:—

"Lengths of each of the woods enumerated in the following table, carefully squared to one and a quarter inch, were submitted to pressure of weights pendent from the centre, the lengths being supported between two standards exactly six feet apart. The weight at which each broke, and the amount of deflection from the horizontal line at the time of breaking, is given.

* Lawson's *Pinetum Britannicum*, Part xxxiii., *Abies Douglasii*.

† Loudon, *Arb. et Frut.*, p. 2467.

‡ *Idem*, p. 2457.

§ Proceedings of the New Zealand Institute, ex. *Gardeners' Chronicle*, 1877, p. 594.

‖ Sir J. D. Hooker, *Address at the Royal Institution*, April 12, 1878.

	lbs.	in.	
Douglas Fir . . .	280	4	fracture rough and long.
Pitch Pine* . . .	280	4	,, short and even.
Canada Spruce† . .	196	4.7	,, short and rough.
Red Pine‡ . . .	168	6	,, rough.
Larch, British . .	168	5.2	,, short and even.
Deodar, from the Himalayas. . . .	154	3.8	,, short.

"The specimens experimented on were carefully selected from the best description of wood, and free from all defects. Each wood had two trials, and the figures give a mean result.

"It will thus be seen that none of the Firs experimented on approached in strength either the Douglas Fir or the Pitch Pine, it having required a weight of 280 lbs. to break a small bar of their wood no more than an inch and a quarter square; 168 lbs. broke a piece of British Larch of the same scantling; moreover, between the Douglas Fir and the Pitch Pine, whose strength was equal, there was this great difference, that while the latter snapped short under a strain of 280 lbs., the Douglas Fir yielded unwillingly with a rough and long rend."

The ELASTICITY of Coniferous wood is very considerable. It was observed centuries ago in the Yew, which led to the wood of that tree being employed in making bows for archery. The woods of the common Spruce, Red and Pitch Pines, and several of the Cypress tribe, are all more or less elastic, which materially enhances their utility in the various purposes of carpentry to which they are applied. The property is, however, most decisively demonstrated by the readiness with which the molecules of the wood receive and transmit the vibrations of sound; this is especially the case in the Fir and Pine tribe. Professor Tyndall,§ in giving the results obtained by the experiments of Wertheim and Chevandier to determine the velocity of sound through different kinds of wood, shows that the velocity along the fibre of Fir wood is fourteen times the velocity in air; in other words, that whereas sound travels under ordinary circumstances through air whose temperature is 60° Fahr. at the rate of 1,120 feet per second, it travels through Fir wood at the rate of 15,218 feet in the same period of time. Also along the fibre of Pine wood it is ten times the velocity in air. He also further proves the elasticity of Fir wood by a beautiful experiment,‖ by which musical sounds generated in one apartment of a building were transmitted through a long deal rod and perfectly reproduced in another. The high degree of elasticity in the molecular structure of Fir and Pine wood renders it a suitable material for the construction of certain parts of

* *Pinus rigida.* † *Abies nigra.* ‡ *Pinus resinosa.*
§ *Lectures on Sound*, p. 41. ‖ *Idem*, p. 80.

several musical instruments, as the violin, piano, &c., for which it is much employed.

The COLOUR of Coniferous wood varies in the different kinds from a deep reddish brown to white. The Yew, the Californian Red Wood, and some others, have deep coloured wood, strongly tinged with red; the Virginian Cedar and the Red and Pitch Pines have red wood; *Thuia gigantea* is commonly known among the settlers in Oregon and British Columbia as the Yellow Cedar, the name having reference to the colour of its wood, and *Pinus mitis* of the Atlantic States is often called the Yellow Pine for the same reason. The timber of the Weymouth Pine and that of its nearest allies is white.

The FRAGRANCE of the wood of many Coniferous trees is powerful, and generally of a resinous odour, in many instances it is also agreeable and even useful. Thus the wood of the Red Cedar, used in the manufacture of pencils, is a familiar example of agreeable fragrance without being too powerful; the wood of the Cembra Pine is much used for wainscotting and the inlaying of wardrobes, on account of its odour being not only agreeable but also obnoxious to insects. The woods of the Deodar Cedar, Yellow Cypress, the American Arbor Vitæ, and the Spanish Juniper, are all agreeably fragrant and more or less obnoxious to insects.

Branches.—The stems or trunks of Coniferous trees are furnished with BRANCHES from the base to the summit, which are generally short in proportion to the height of the trunk, and, except in the case of the Cedar of Lebanon, the Yew, and some of the Pines, which have long and spreading branches, they rarely attain a timber-like size. In the Fir and Pine tribe the branches are whorled, that is to say they are produced around the trunk in every direction in tiers, growing either horizontally or slightly inclined upwards till they bend downwards by the weight of their appendages. Each tier or whorl springs from buds protected by membranous scales, which are cast off when the young shoots begin to push into growth; the buds being produced at the point of the stem which terminates the growth of the season previous to that in which the branches first appear, so that the intervals between the whorls show the height the stem has made in successive seasons.* Very often single branches are produced between the whorls, but these may be regarded as adventitious, and they are generally much weaker in their growth than the others. In all the other tribes, the branches are produced

* Hence, where the whorls are all present from the base to the summit a rough approximation of the age of the tree can be arrived at.

around the trunk at close irregular intervals, and are generally spreading, but there are many kinds whose branches grow as upright as the trunk, and give the trees a fastigiate habit.

In the Abietineæ and Taxodiæ the lower branches are cast off at a very early age, if the trees are in a confined situation or in close proximity to one another; but they are retained for many years if the trees stand singly with a free circulation of air around them.

In most of the species the branches ramify from their sides only, the branchlets divide and sub-divide in the same way, so that the entire bough is flat or frondose. This flatness is remarkable in some kinds, as the Cedar of Lebanon, the Torreyas, some of the Silver Firs and Araucarias, in which the branches and their appendages are quite rigid, and give the tree a stiff and formal appearance. In many other kinds the primary branch remains more or less rigid, while the appendages are flexible and pendulous as the Deodar Cedar, the Larches, and the Himalayan and Hemlock Spruces. In the true Pines, the branchlets are whorled like their primaries, and are produced from the termination of each year's growth. In some of the Cypresses, Junipers, and a few others, the secondary branchlets are produced on all sides of their primaries, and at acute angles to them, giving the tree a dense, compact, or bushy habit.

Leaves.—The LEAVES present much diversity in form and arrangement. In form, narrowness in comparison with length is the prevailing characteristic in most of the species cultivated in Great Britain; but there are some broad-leaved kinds not hardy in this country, as the Dammaras of Australia and the East Indian Archipelago. In the true Pines the leaves are linear or filiform, in some species exceeding a foot in length, and of extreme tenuity;* in others, not exceeding one inch;† in Abies they are linear, or linear-lanceolate, tetragonal or flattened, with their points acute, blunt, or emarginate. In Cedrus, Larix, and many of the Junipers, they are acicular or needle-shaped and straight; in Cryptomeria, and in some of the Araucarias, they are acicular and curved; in Taxodium, the Red Wood, and in most of the Yew tribe they are linear, flattened, and pointed, and, in the Torreyas, terminated by a sharp spine or

* As in *Pinus longifolia*, an Indian species. † As in *Pinus parviflora*, &c.

bristle. In the Cypress and its allies they are dimorphous, the earliest formed or "juvenile" leaves being linear, flattened, and frequently falcate; the mature or adult ones, scale-like, rounded, or pointed at their apices. In Ginkgo the form of the leaves is unusual, being broadly fan-shaped, with the edges jagged or much notched. Many other forms occur in the Australian and other genera.* The arrangement of the leaves is also much varied. In the true Pines they are spirally set around the branches in bundles of twos, threes, and fives, each bundle being enclosed at the base in a sheath composed of membranous scales, which are deciduous in some species.† In the Spruce Firs, Cryptomerias, Wellingtonia, and others, the leaves are densely scattered over the branchlets, or spirally arranged around them, and often pointing laterally in two directions. In most of the Silver Firs, the Hemlock Firs, Taxodium, the Red Wood, and most of the Yew tribe, they are distichous (two rowed) or pectinate; in Cedrus and Larix, fasciculated; in many of the Junipers, in whorls of three's; in the Cypress tribe, generally closely imbricated in four rows. The persistency of the leaves varies in the different tribes; the Larch, Deciduous Cypress, Chinese Water Pine, and Maiden-Hair Tree are deciduous; in some of the Pines the leaves remain on the trees several years, and *Araucaria imbricata* retains its foliage from ten to fifteen years. In all the tribes, with the exception of the Maiden-Hair Tree (Ginkgo), the leaves are entire at their edges, but in Pinus the edges are frequently rough, with serrations invisible to the naked eye; the veins are parallel; and the stomata, when present, are regularly arranged in rows, sometimes interrupted, and in many species found on the upper as well as on the under surface.

The colour of the foliage is not less varied than the forms of the leaves. From the deep sombre hues of the Austrian Pine and Common Yew to the light and airy deciduous Cypress and Maiden-Hair Tree, the silvery lines of the Weymouth Pine, and the greyish foliage of *Retinospora squarrosa*, there is found in the different tribes an endless variety of tints which the green of Nature alone displays.

* Among these Phyllocladus is remarkable for having "leaves of two forms, some minute and scale-like, others linear, seen only in young plants, but which in older are connate into flat fan-shaped organs (phyllodes), resembling simple leaves, which bear the inflorescence at their edges."—Sir J. D. Hooker, *New Zealand Flora*, p. 259.

† These scales are, by some botanists, regarded as imperfect leaves, from the axils of which the true leaves arise.

The deep glossy green of the leaves of *Abies bracteata* renders that remarkable tree not less distinct and imposing than does its tall spiry habit of growth. The pleasing glaucous hue of the Deodar Cedar is almost unique, and the rich deep colour of *Libocedrus decurrens* is scarcely less so; *Pinus insignis* is distinguished among all Pines by its cheerful grass-green foliage, which affords a striking contrast to the dull grey hues of many of its congeners; the difference in colour between *Abies nobilis* and *A. Nordmanniana* is not less marked. The foliage of *Cryptomeria elegans* changes in winter to a deep bronzy green tinged with crimson, which makes this plant particularly ornamental at that season, and a similar change takes place in *Retinospora (Thuia) ericoides*, which becomes violet purple.* The common Arbor Vitæ is brownish green, while varieties of the Chinese species have their foliage of a rich golden-yellow during the growing season. Many of the Junipers have a bluish glaucous tinge peculiar to them, and others are quite grey.

Besides the difference in tints above sketched, the foliage of Coniferous plants is subject to two changes in colour, viz., VARIEGATION and GLAUCESCENCE, the causes of which have not yet been clearly made out. Variegation shows itself in the young growth of the plants, which, instead of appearing in the shade of green natural to the species, takes some shade of yellow that varies in the different kinds from a deep golden hue to a creamy white. In some cases the whole of the newly formed branchlets with their foliage is produced coloured.† As the season advances, the tint gradually changes, first by becoming deeper, then taking a perceptible shade of green, and finally in the course of the second season, assuming the green natural to the species, but not till a new coloured growth is formed. This kind of variegation is observed to be tolerably constant in whatever description of soil the plant is growing, but the intensity of the colouring is slightly different in different soils, being most developed in clayey loams. In other cases the tips of a portion of the branches only appear coloured, the extent of the variegation ranging in different and in the same species from a mere spot to a considerable portion of the branch. It is only in this form that a white variegation appears. Plants variegated in the manner first described, continue to produce coloured foliage year after year without manifesting any special signs of debility or decay; but their rate of growth is always *slower* than that of the normal forms. Plants partially variegated often show signs of disease in the coloured parts, which turn brown and die, in some cases

* The foliage of all or nearly all the Coniferæ of temperate climates changes colour in winter more or less. This is due to the low temperature of that season, which causes a peculiar transformation of the blue green constituent of chlorophyl. A higher temperature restores the normal condition.—Sach's *Lehrbuch*, p. 705.

† As in *Retinospora obtusa aurea, R. plumosa aurea, Thuia aurea, Taxus baccata aurea, Juniperus chinensis aurea, Thuia elegantissima*, &c.

within a few weeks after it is produced, especially if the plant is exposed to the direct action of the sun's rays. Partial variegation in vigorous growing kinds often disappears entirely in the course of a few years; it is also greatly influenced by the soil in which the plants are growing, being heightened in some situations or soon becoming obliterated in others.

Glaucescence is quite distinct from variegation; it makes its appearance indifferently in young and old plants. It is always present in the foliage of many species, in some of which it becomes greatly heightened by age; it also frequently appears with great intensity in the young plants of species that are normally quite green or show it but very faintly. The effect of glaucescence, as regards the aspect of the trees, is to give them a greyish silvery hue, particularly pleasing and beautiful in many plants belonging to the Cypress tribe and to the Firs; while it imparts a venerable hoary appearance to aged Pines, and especially to the Cedar of Lebanon. It is believed to be due in one form to the stomata of the leaves, and it is not improbably an optical effect arising from their close proximity and formal arrangement, especially in the case of the white lines seen on the under surfaces of the leaves of the Silver and other Firs, and in the leaves of Pines, Junipers, &c. In another form it is caused by a resinous secretion which is easily rubbed off by the finger, leaving the leaf quite green.

Flowers.—The FLOWERS are always without perianth, and are either monœcious, as in the Fir and Pine tribe, or dicœcious, as in the Yew and Juniper.* Taking the flowers of the common Spruce, the Larch, or the Scotch Pine (they are identical in their general structure) as the type, we find the arrangement of their parts to be thus:—The male flowers are short catkins, consisting of a central axis to which are attached minute imbricated scales, each scale bearing at its extremity on the under side a pair of anther lobes, which burst longitudinally; the female catkins also consist of a central axis, with closely imbricating spirally arranged scales, each having at the base on its upper surface a pair of inverted ovules. The pollen grains fall direct upon the ovules, so that fertilization takes place without the intervention of style or stigma. In the Cypress and Yew tribes this type is slightly departed from, but they agree in having naked ovules; in the former the scales of the male catkins bear generally

Fig. 4. — Male or Anther-bearing Catkin of Spruce Fir. Natural size.

* With a slight qualification—The Junipers and Taxads are not absolutely dicœcious, but relatively so, monœcious plants having been observed.

two, three, or more anther cells, those of the female have numerous erect ovules; in the latter the male flowers consist of peltate scales, each with from two to eight anther lobes, and the female ones, which are either solitary or in groups, of a single erect ovule in the middle of a small cupuliform disc.

Fig. 5.—Female or Ovule-bearing Catkin of Spruce Fir. Natural size.

Being destitute of calyx and corolla, the flowers of Coniferous plants are also wanting in the brilliant hues that distinguish the flowers of most of the higher orders. Nevertheless, there are some species which have the scales of their pollen bearing flowers highly coloured; in *Pinus ponderosa*, these are bright red, and being produced in large clusters are very conspicuous; in *P. Laricio* and its allies, they are yellow; in *P. excelsa*, purple; in *P. macrocarpa*, orange; in *Cupressus Lawsoniana*, crimson; in the Chinese Juniper, the Arbor Vitæ, and some others they are yellow. The quantity of pollen produced by the male flowers of a single tree is often surprisingly great; a puff of wind has been observed to scatter the pollen of an *Araucaria imbricata* like a cloud of dust; the surface of the ground beneath a Spruce Fir that has shed its pollen is made quite yellow with fine dust; and in a forest of Pine and Fir, the quantity of pollen is sometimes such as to produce effects almost exceeding belief. "In Inverness-shire, a great shower of the pollen of the Fir took place in 1858, the ground was covered by a layer of this substance in some places to a depth of half an inch, and the deposit was noticed at places thirty-three miles apart. The whole surface of the great lakes in Canada is not unfrequently covered by a thick scum of the same pollen. Similar occurrences have been noticed in the forests of Norway and Lithuania." (*Coal, by the Professors of the Yorkshire College*, p. 24.)

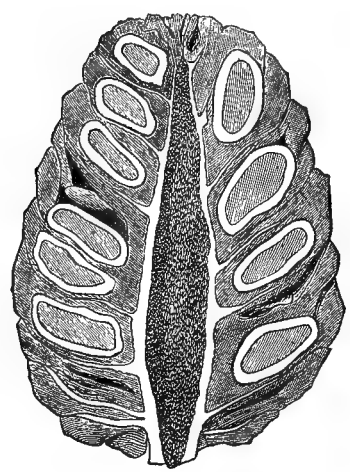


Fig. 6.—Longitudinal section of a cone of the Stone Pine (*Pinus pinea*), showing the relative positions of the axis, scales, and seed. Two-thirds natural size.

Fruit.—The FRUIT is simply an assemblage of seeds enclosed by the mature ovule producing scales. In the Fir and Pine tribe the scales are hard and ligneous in texture, imbricated, closely

appressed, sometimes adherent, and spirally arranged around a common axis. At the base of each scale, on the side away from the axis, is a bract, which varies much in form and size in the different kinds, in some large and protruding beyond the scales, in others minute and enclosed by them. The scales are regarded as carpellary leaves which have not folded round the ovules; the bracts are now known to be metamorphosed foliage leaves. The fruit is generally of a conical form, but this form is considerably modified in the different genera, being nearly cylindrical in the Silver Firs, ovoid in many of the Pines, greatly elongated in others, and almost spherical in some of the Araucarias. In the Cypress tribe, the scales are peltate and arranged in opposite pairs, the entire fruit being spherical or ovoid. In Juniperus, the ovule bearing scales become fleshy, and by their coalescence (always in threes) form a berry. In the Yew tribe, in which the female flowers are either solitary or clustered, the scale is developed into a succulent disc.* In the Sequoia tribe (Taxodiæ) the cones may be regarded as intermediate between those of the Abietineæ and Cupressineæ, combining the general appearance and form of some of the former with much of the structure of the latter, the scales enclosing from three to nine seeds according to the kind. They have, however, a peculiarity which must be noted. The axis in some species frequently continues to grow after the cone is formed, and there is produced on the apex a whorl or fascicle of leaves, differing in

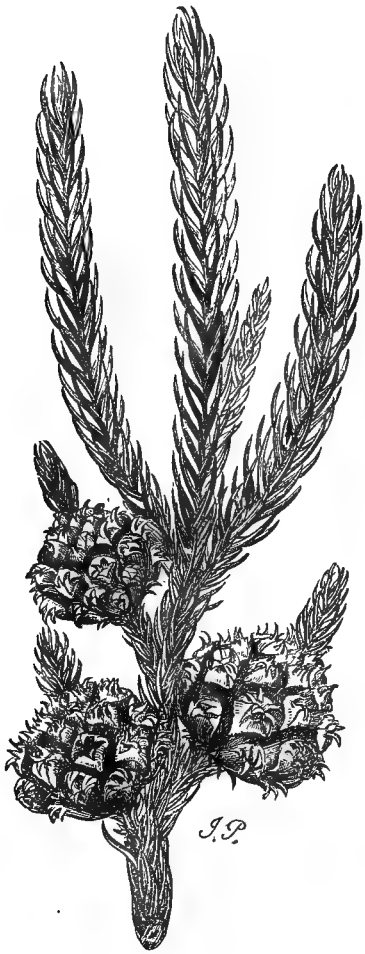


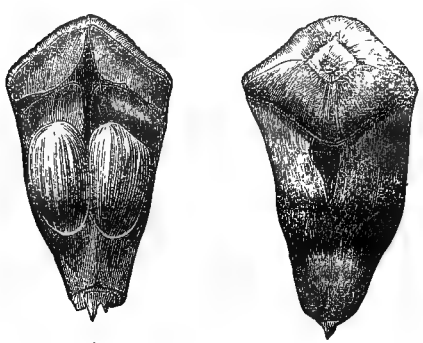
Fig. 7.—Fertile branchlet of *Cryptomeria japonica*, var. *Lobbi*, with cones having prolonged axes, bearing foliage leaves at their apices.

* Technically called an *arillus*.

nothing from the ordinary foliage-leaves of the species. This peculiarity is most common in Cryptomeria, and is not infrequent in Sciadopitys.

The cones of the different genera and species differ as much in size and colour as they do in form; the berries of some of the Savin Junipers are smaller than the smallest garden peas, while the cone of the Moreton Bay Pine (*Araucaria Bidwilli*) is almost as large as a man's head; the small cone or strobile of *Retinospora pisifera* is less than half an inch long; the cone of the Californian Sugar Pine (*P. Lambertiana*) is nearly two feet in length. It takes several cones of the common Hemlock Spruce to weigh an ounce; a single cone of *Pinus macrocarpa* weighs from four to five pounds. Although the cones of the great majority of the species are of a dull and unattractive colour, there are some remarkable exceptions; the cones of *Abies Webbiana* during the period of growth are of a deep blackish violet-purple, and are strikingly beautiful; those of *A. nobilis* are of a bright pea-green during their progress towards maturity, which, with the symmetrical arrangement of the scales and protruding bracts and their large size, render them very beautiful objects. The ripe berries of the Yew are bright red, and in one variety orange-yellow, which, when produced in profusion, give the trees by their contrast to the dark sombre foliage, a very ornamental appearance.

Seeds.—The SEEDS are produced singly,* in pairs,† or in greater number,‡ according to the ovules in each scale, but sometimes fewer by abortion. They are contained in a bony, leathery, or membranous tegument, often prolonged into one or two membranous wings. The embryo is enclosed in a farinaceous or fleshy albumen, more or less impregnated with resin. The cotyledons vary in number from three to fifteen, but according to Parlatore there are only two, these being so deeply divided as to appear numerous (*Cotyledones profunde partitæ unde videntur, III.—XV.*). The seeds vary much in size and shape in



1. 2.

Fig. 8.—Scale of Pinus pinea, natural size. 1. Inner side, with seeds. 2. Outer side, showing the swollen terminal portion called the *apophysis*, with its central protuberance.

* Araucaria, Yew. † Abies, Pinus, &c. ‡ Cypress, Taxodium, &c.

the different genera, and even in species included in the same genus. Thus, in Pinus, they are generally ovoid or obovoid with the greater diameter of the smaller seeds, as those of *P. Strobus* not more than one-fifth of an inch, while those of *P. Sabiniana* are almost as large as a filbert. In Abies and Cedrus they are broadly wedge-shaped; in Taxodium, angular; in Sequoia, disc-like and compressed; in some species of Cypress, ear-shaped, &c. In *Araucaria imbricata*, the scale, bract, and seed all coalesce into an elongated wedge-like form.

It is a very remarkable fact that some of the largest of trees spring from the smallest of seeds. Thus, the gigantic Sequoias of California, the Wellingtonia, and the Red Wood have seeds less than one-tenth of an inch in diameter, and each seed contains no more matter than a grain of mustard seed. The seeds of the Deodar Cedar are smaller than those of some of our garden herbs, and the seeds of the Hemlock Firs are among the smallest of tree seeds. The seeds of *Pinus monophylla* and *P. koraiensis*, both low trees, are half as large again as those of their congener *P. Lambertiana*, which towers to ten times their height, and many other instances might be cited. The larger seeds are edible, and although the resinous flavour is never entirely absent, it may be got rid of by boiling or roasting; they are then not only palatable, but even agreeable. The seeds of *Araucaria imbricata*, *Pinus Sabiniana*, *P. Lambertiana*, *P. longifolia*, *P. pinea*, and some other species, are all used as food by the inhabitants of the countries of which these trees are native; and from the seeds of *Pinus Cembra* is expressed a valuable oil used for lamps.

Under cultivation, and sown in the open ground, the seeds of most of the hardy kinds germinate within six or eight weeks after being sown, and not unfrequently less under favourable circumstances. During the first season the growth of the seedling is slow, rising not more than an inch or two above the ground, and having no more leaves than can be easily counted; it is not till the second or third year, and some kinds still later, that a decided push upwards takes place.

The seed of each species produces plants "after its kind," but innumerable departures from a fixed type are of constant occurrence, and many of them so remarkable, that were their origin unknown, they would, on superficial glance, be taken for quite distinct kinds. Among such may be noted the Irish Yew, Clanbrasil's Fir, the erect Lawson's Cypress, and the Whipcord Arbor Vitæ. Besides these, which may be called extreme forms, every bed of seedling plants shows numberless variations in habit, foliage, or some minor particular. Coniferæ, therefore, like many of the lower forms of vegetation, as

Ferns, are *polymorphous*,* a principle that manifests itself throughout the order, but is much more common in some tribes than in others; it is less frequent in Pinus than in Abies, very usual in the Yew, and most common in the Cypress tribe (Cupressus, Thuia, Retinospora, Juniperus, &c.). It is most observable in plants in their young state, but when the departure from the usual type is not very great, the difference gradually disappears as the plant becomes older.

Secretions.—The SECRETIONS are abundant, and flow copiously from wounds made in the stems of the trees during the growing season, especially in the Fir and Pine tribe; they are known as Turpentine, Resin, Tar, &c., which are much used in the arts, chiefly as preservatives against decay. "The turpentine is generally contained in special receptacles in the substance of the wood, but sometimes it collects in blisters underneath the bark, which appear during the strong heats of summer. It flows from these as a liquid juice, which thickens on exposure to the atmosphere, when incisions are made in the stem."† The crude turpentine thus obtained consists of a volatile or essential oil and resin, which can be separated by distillation. Oil of turpentine in its pure state is a colourless liquid of powerful odour,‡ almost insoluble in water, but dissolving in alcohol or ether, and absorbing oxygen rapidly from the air, especially when mixed with ceruse or white lead; it dissolves sulphur, and is a good solvent for grease.§ It is also a powerful solvent for resins, which form the bases of most varnishes, and from its great volatility, it quickly flies off or dries away, leaving a thin coat of the varnishing substance on the surface on which it has been applied.‖ It is the only known volatile oil that mixes readily with paint without affecting its essential properties, diluting it that it may flow freely from the painter's brush, and by its volatility causing the paint to dry rapidly. Tar is impure Turpentine, altered by the heat used to separate it from the wood. Pitch is simply Tar

* This word explains nothing, it simply expresses a phenomenon, the cause of which lies deeper than physiological science has yet reached.

† Dr. Carpenter, *Vegetable Physiology*, p. 213.

‡ Chemically a hydro-carbon, having for its formula C^{10} H^{16}, specific gravity 0.86 (when pure distilled water at 15° C. is 1), it boils at 160° C.—*Chemistry*, by Dr. Williams, in Clarendon Press Series, § 348.

§ *Idem.*

‖ Dr. Carpenter, *Vegetable Physiology*, p. 213.

deprived of its volatile part. The Resin left in the still after the separation of the essential oil differs in appearance and properties according to the amount of impurities contained in it. The best Resin is brownish yellow, crystalises in small rhombic prisms, is insoluble in water but is dissolved by alcohol; it is a non-conductor of electricity, and in its fossil state is known as amber.

The resinous products of Coniferous trees are enumerated by Dr. Lindley* as follows :—" Common and Burgundy Pitch are obtained from *Pinus sylvestris;* Hungarian Balsam from *P. montana;* a most fragrant resin from *Araucaria brasiliensis;* a hard brittle resin like copal from *Dammara australis;* Bordeaux turpentine from *Pinus pinaster;* Carpathian balsam from *P. pinea?* Strasburg turpentine from *Abies pectinata;* Canadian balsam from *A. balsamea.* The common Larch yields Venetian turpentine, and a saccharine matter called Manna of Briançon exudes from the branches. Liquid storax is thought to be yielded by the Dammar Pine.† Sandarach, a whitish-yellow, brittle, inflammable, resinous substance with an acrid aromatic taste, is said by Brongniart to be the *tears* of *Callitris quadrivalvis.* The substance from which Spruce beer is made is an extract from the branches of *Abies canadensis* and of *A. nigra.* Great tanning powers exist in the bark of the Larch. The stimulating diuretic powers of *Juniperus Sabina* are well known, and are partaken of in some degree by the common Juniper, the diuretic berries of which are an ingredient in flavouring gin; the fetid oil of *Juniperus oxycedrus* is employed in veterinary practice." From the descending sap of the Larch and other trees of the Pine and Fir tribe is obtained the substance called Coniferine, which, by a comparatively recent discovery, can be transformed into Vanilline, the aromatic principles present in the seed vessels of Vanilla. The collecting of Coniferine has quite lately become a profitable branch of industry in North Germany.

The amount of the secretions yielded by Coniferous trees appears to be influenced by the heat or moisture of the climate; the former acting as a stimulant, and the latter as a check to their production. The Pine forests in the Mediterranean region and the plantations in the south of France supply turpentine in greater quantity and of better quality than that obtained further north, while the Pine Forests of Sweden and Norway supply only the coarser products as tar and pitch. The turpentine of American commerce is procured chiefly from the extensive " Pine Barrens " of the South Eastern States, where, during the great heats of summer, it flows from the trees so copiously as to require but a comparatively small amount of labour to obtain it. In the great pine woods of Canada, it would not at present

* *The Vegetable Kingdom*, p. 229. † *Dammara orientalis.*

repay the cost of collecting for exportation, in consequence of the cheaper rate at which it is procured further south. The Coniferæ of the Himalayas yield but a small amount of resinous products owing to the humidity of the climate;* and in Britain—although the more equable temperature of summer and winter, especially in the districts of the greatest rainfall, is favourable to the rapid growth of the trees—the resinous products are not sufficiently abundant to be worth collecting.

The Turpentine imported into Great Britain exceeds half a million of cwts. annually. The Tar received from the north of Europe, obtained from *Pinus sylvestris*, and used chiefly in shipbuilding (of which the Stockholm Tar of commerce is considered the best), and that from North America, obtained from *Pinus australis*, *P. Tæda*, *P. rigida*, &c., exceeds yearly five millions of gallons. The distillation of tar, both in Europe and America, is usually performed in a very rude manner, involving an enormous waste of material. "A funnel-shaped hole is dug in a bank, about six or eight feet in diameter at the upper part and not more than ten inches at the lower. At the bottom of the hole is placed an iron pan having a long pipe or spout which is made to pass through the bank; the hole is then filled up with billets cut from the roots and branches of the Pine Trees, which, after being kindled at the top, are covered over incompletely with turf. The wood is then charred from above downwards, and the tar, mixed with various other products, flows off at the bottom through the spout into a receiver." †

DISEASES AND ACCIDENTS.

Coniferous plants are liable to DISEASE, which manifests itself in various forms, the most common as well as the most virulent being fungoid. One kind of fungoid disease commences at the roots, spreading up from thence to the layers of wood immediately surrounding the pith, which in the course of a few years become soft and rotten. ‡ This disease has proved very destructive to Larch, and is commonly known as Larch-rot. Another form of fungus attacks the stem and branches, kills the bark on which it settles, but leaves the roots and interior healthy. § Disease also arises from the absorption by the roots of deleterious matters in the soil

* "It is a curious circumstance that none of the Himalayan Conifers produce any quantity of resin, turpentine, or pitch, which may perhaps be accounted for by the humidity of the climate.—Sir J. D. Hooker, *Himalayan Journals*, II. 45.

† *Chambers' Encyclopædia of Useful Knowledge.*

‡ Rev. M. J. Berkeley, in *Gardeners' Chronicle*, 1859, p. 1015.

§ *Idem.*

in which the plants are growing; from the stagnation of water at their roots, and from being planted in places under the influence of the smoke of large towns. Another source of disease is an excessive flow of sap from wounds or mutilation of the trees during the growing season, for which they have no adequate compensating or healing power, and which are aggravated by the rapid formation and flow of the resinous secretions.

The Rev. M. J. Berkeley states that one of the fungoid diseases which proves so destructive to Larch,* "is generated on the roots of felled trees that have been left in the ground, whence it spreads to the roots of the living plants. The spores penetrate the tissues of the tree in the form of white fibres or threads, which first impair and finally destroy the vitality of the parts they infest. This disease occurs in almost any kind of soil; it is found to be more especially prevalent where the land does not admit of complete drainage, a circumstance which appears to be supported by the fact that the Larch in its native mountains flourish most where, though abundantly supplied with moisture, the water never stagnates.† These fungi are known by the scientific names of *Polyphorus abietinus*, *P. destructor*, and *P. versicolor*. Scarcely any Coniferous tree is exempt from their ravages; Pinus, Cedrus, Cypress, &c., have been killed by them, the evil invariably originating from the roots that have been left in the ground, and which seem to have an especial power in generating them.‡ The fungoid parasite which attacks the stems and branches of Conifers is called *Peziza calycina*,§ it may be found on every branch that has been left on the ground after thinning. The evil from this cause commences where the bark has suffered from some unknown accident, and the secreting surface whether of the bark or the wood beneath it dies.‖

Disease arising from deleterious matters absorbed by the roots, shows itself in the yellowish sickly appearance of the foliage followed by the stunted growth of the leader and terminal branchlets. It occurs in soils containing soluble matters taken up by the spongelets of the roots, and which, being deposited in the vessels and tubes, first obstruct and finally prevent the free circulation of the sap before the season's growth is completed. It has been observed that *Abies Douglasii* and *A. nobilis* will not live upon oolite soils,¶ it is also well known that many other kinds do not thrive upon chalk and limestone soils. The readiness with which foreign matter is taken up by water, is familiar in the case of "hard" water, which contains

* *Gardeners' Chronicle*, 1859, p. 1015.
† *Idem*, 1863, p. 244. ‡ *Idem*, 1867, p. 26. § *Idem*, 1859, p. 1015.
‖ *Idem*, 1859, p. 1015. ¶ *Idem*, 1865, p. 291.

lime, "chalybeate" waters, iron, "hepatic" waters, sulphurated hydrogen, &c.*

Stagnation of water at the roots induces disease by the "growing points" of the spongelets being too much stimulated into growth in the low temperature at which water-logged soil is always found.† The roots exposed to the action of the water soon become debilitated and unable to perform their functions, they die and rot; fungus (Polyphorus) is generated, which soon spreads over the living as well as the dead parts, and the plant perishes.

The destructive action of smoke is seen in the sooty particles that settle on the foliage and bark of the branches. The stomata of the leaves and the pores of the bark of the young shoots are thus choked, and the functions of these organs permanently injured; the foliage falls off before its usual term of persistency is complete, and the plants have that denuded unsightly appearance so commonly seen in the immediate vicinity of London and other large towns.

Wounds and the mutilation of young Coniferous trees during the season of active growth often causes their death, through an excessive flow of the sap. "The sap like the blood oozes out or escapes at the newly-made wound; its passage is a mute protest against our violence, and whispers to the wise operator as it flows, to make as few wounds as possible. All the sap that thus exudes is lost, it represents so much waste of vital energy. But in the case of Conifers it does more than this, the wounds are apt to become festering sores, they attract towards them the secretions of the plant, to be not simply discharged and lost, but to form centres of incurable disease, ending often in running sores and life-long exudations of gummy and resinous matter."‡ A remarkable instance of wounding was once brought under our notice. A man while mowing had cut round the stem of a large *Araucaria imbricata* in vigorous growth with his scythe; the flow of sap from the wound was so incessant, that the tree bled to death in spite of all efforts to stop it. It is evident, therefore, that the pruning of Coniferous trees, especially those belonging to the Fir and Pine tribe in which the circulation of the sap is exceedingly active, cannot be too strongly deprecated. If practised at all, it should be restricted to the cutting or heading back of the fewest shoots possible, and this should be performed in winter when the risk is least. It is the want of an adequate compensating power in the Fir and Pine tribe to repair injuries, that renders it not only injudicious but even dangerous to amputate branches in vigorous health at any season.

* *See* Chemistry by Professor Williamson, p. 619.

† Dr. Lindley observes:—"Water is not of itself an evil; on the contrary, it is the food of plants, and its absence is attended with fatal results. It is the excess of water which injures plants, just as an excess of food injures animals."—*Theory and Practice of Horticulture*, p. 137.

‡ *Gardeners' Chronicle*, 1868, p. 761.

A compensating power, such as the formation of healing tissues which close over wounds, is present in the other tribes in a much higher degree, and hence the trees and shrubs belonging to them may be cut with far less risk of injury. This power exists to such an extraordinary extent in the Yew, that it may be deprived of its young growth annually, for a long succession of years, without destroying its vitality; it is thus an invaluable hedge plant. In Part III., we have given a selection of Coniferæ suitable for the formation of hedges, with hints for their treatment.

Coniferous trees and shrubs are frequently injured and disfigured by domestic and other animals, if not protected from their depredations. Horses will bite off the young shoots of most of the kinds usually planted for the beautifying of the park and landscape; sheep and deer have been known to permanently disfigure young Araucarias, Deodars, and other kinds to which they have obtained access. Nor is the Yew exempt from attack, although the young branches and foliage can never be eaten by cattle without dangerous, if not fatal results.* Hares and rabbits will gnaw the bark of young Conifers in all seasons of the year, but chiefly in winter, giving a preference to members of the Cypress tribe when within their reach, probably on account of the resinous secretions of these trees being less abundant than in the Fir and Pine tribe, although the latter are by no means free from their attacks. Squirrels destroy the green and immature cones of Firs and Pines in great numbers, as well as the ripe seeds which are an important item of their winter provisions; they also eat the buds of the same trees; they attack the bark of the Scotch Fir and Larch, especially in young plantations, but eating the inner bark only, frequently destroying the tree or rendering it of no value; and they have been known to strip off the tough fibrous bark of the Red Wood and Wellingtonia for material for their nests. Birds will peck off the buds of the Fir and Pine when other resources are scarce, and they will also use the fibres of the bark of the Red Wood in the construction of their nests.†

* The necessity of guarding Yew trees that have not lost their lower branches, beyond the reach of cattle cannot be too strongly insisted upon, not so much for the sake of the trees, as for the safety of the animals.

† The mischief done by birds to Coniferous trees is really insignificant, and is more than counterbalanced by the good they do in destroying the larvæ of the insects that prey upon them.

Heavy as the indictment for mischief against the larger animals appears to be, it is comparatively light to that which must be preferred for the ravages committed by insects, which prove infinitely the more destructive as they are the more numerous and their mode of attack the more insidious. Scarcely any Coniferous plants can be said to be free from their depredations, although it is among the timber-producing trees of the Fir and Pine tribe that the evil caused by these minute marauders is the most serious. The Scotch, Weymouth, and other Pines are frequently infested by a species of beetle known as the Pine Beetle,* which deposits its eggs in the bark and buds of young trees; the larvæ eat out the interior of the buds and young shoots during the period of active growth, and thus check and even permanently injure the trees they attack. The Typographer Beetle,† so called from the passages made in the wood by its larvæ in eating their way out having a fancied resemblance to alphabetical letters, attacks the Silver Fir, but will also commit ravages on other kinds where the Silver Fir is scarce.‡ Pines are also attacked by a large kind of weevil,§ which pierces the bark with its trunk, "thus rendering the tree unhealthy prior to the female depositing her eggs." The Larch blight is caused by a kind of beetle,‖ which deposits its eggs in the crevices of the bark, whence they are propagated with marvellous rapidity in the Spring months. An insect called Sirex is particularly destructive to Fir timber; the wood is pierced and bored in all directions by this pest, and it is not till after the trees have been felled that its ravages are manifest.

The Irish Juniper is often disfigured by the larvæ of a moth, called the Juniper Moth; and even the Yew, poisonous as it is to the larger animals, is the home of an insect to which entomologists give the name of *Cecidonyea Taxi*. These are but a few of the best known and most destructive kinds observed in Britain. There is, however, a counterpoise found even among insects. "It is well known that while there are multitudes of

* *Hylurgus piniperda.* See *Gardeners' Chronicle* for 1846, p. 720, where an account of this insect is given; also for 1869, p. 967.

† *Bostrichus typographus.* Mr. Robert Hutchison, in *Proceedings of the Scotch Arboricultural Society*, 1874.

‡ *Idem.* § *Pisodes notatus.* ‖ *Bostrichus laricio.*

noxious insects devastating whole forests, there are also many useful little animals which, by their operations, may be said to act as the good genii of all trees, and chiefly of the Coniferous tribe." Among the latter may be mentioned the Ichneumon flies, which destroy myriads of caterpillars that infest Fir and Pine trees, and also a little insect to which Linnæus gave the name of *Thanasimus formicarius*, "whose destructive abilities are truly marvellous, depositing its eggs not unfrequently in the wood boring larvæ themselves, as well as in the bodies of many other destructive insects." *

Observations made on the habits of the insects destructive to Coniferous trees, tend to show, that much of the mischief caused by them, may be prevented by forethought and judicious management. Mr. Robert Hutchison in the excellent paper above quoted, points out that "trees of the Pine tribe most frequently affected in their young stage by the attacks of insects, are those which are planted in soil previously cropped by the same description of tree. This will also be the case even although the previous crop may not have been affected in the least degree by such ravages, thus clearly showing that the cause of the destruction to the second crop does not lie in any sort of infection or transmission of the disease (if so it may be called), but rather from the growth and establishment of larvæ in the ground itself, engendered probably by the dry condition of the soil, caused by the previous cropping and absorption of the moisture by the numerous roots left in the ground after felling.

"Another fact worthy of notice is, that these marauders of Coniferous plantations seem greatly enamoured of the cut and drying twigs and branches from early prunings or thinnings. It has been frequently observed that they prefer locating themselves among these cut branches to any other shelter or cover, so long as they find them in a fresh although drying condition, and they will invariably settle on them rather than on any part of the growing trees themselves. This predilection for shoots in a semi-dry or half withered state is further attested by the circumstance that insects which attack the Fir tribe, invariably commence on a subject already evincing indications of sickness or decay."

"The modes of insect attacks upon Coniferous trees may be directed towards the root, the bark, or the tender young shoots; but in any case their preference for the apparently weaker growths and constitutions holds good, whatever may be the mode of attack, and whether their victim be a recently planted seedling or a mature tree. They probably,

* Mr. Robert Hutchison in *Proceedings of the Scotch Arboricultural Society*, 1874.

in the first instance, feed on their prey, and then breed in the cavities which their predacious attacks have made."

"The season when insects are most injurious to Coniferous woods is generally from the beginning of April to the end of June, and again from about the beginning of August till the middle or end of September, in favourable and mild weather, or ordinary seasons. Cold or wet weather may affect their operations, but, as a rule, these are the times of the year during which the greatest havoc is committed. Hot and dry summer weather, especially if succeeded by a cold, dry, frosty winter, favours the dissemination and increase of forest feeding insects. The warmth of summer fosters their breeding, because by its genial influence their period of transformation from the larvæ state is shortened, and abundance of time is afforded for several broods to mature in succession, and when the following winter is dry, a super-abundant number of insects will be found in the coming spring; while on the other hand, should the summer season prove wet and deficient in sunshine, and the following autumn and winter be damp, intensely cold or snowy, the numbers of insects whose increase had been previously checked by the adverse summer will be materially lessened in the following spring, and the destruction to the woods for the time will be proportionately lessened."

Our space does not permit us to pursue this interesting subject further; we must therefore refer those of our readers desirous of further information, to the excellent paper from which the foregoing extracts are taken.

Accidents from meteorological phenomena, as winds, snow storms, lightning, &c., require but a passing notice. The leaders of trees belonging to the Fir and Pine tribe, and some of the Taxodiæ, are sometimes snapped off by high winds. When the breakage includes no more of the stem than the last season's growth, the injury is often repaired in Firs and Pines, by one of the branches in the uppermost whorl gradually ascending and taking the place of the missing leader. But not unfrequently more than one of the branches in the highest tier become transformed into leaders; the stem thence becomes forked, and the symmetry of the tree impaired. The remedy in that case is simply to remove the weaker of the rival leaders. If more of the trunk than the latest growth is broken off the tree becomes irremediably deformed. When the breakage occurs near the ground, the injury results in the death of the tree, as no member of the Fir and Pine tribe has the power of sending out new shoots from any part of its trunk or from its roots. Breakage by

snow will permanently disfigure a tree whose branches have not sufficient elasticity to yield to the weight without fracture. The frondose branches of most Coniferæ, with their dense clothing of foliage, offer peculiar facilities for the resting of snow upon them, and the weight of this, especially after being partially thawed and then frozen, acts as a severe strain upon them. In the case of young trees planted as specimens for the decoration of the lawn and pleasure grounds, it is evidently advisable to relieve the branches of at least a portion of their superincumbent weight after a heavy fall of snow. The destruction of Coniferous trees by lightning is, at least in this country, a rare occurrence. Whether this apparent immunity is in any way owing to the resin contained in the wood and sap, resin being one of the most perfect non-conductors of electricity, does not appear to have been investigated.

DISTRIBUTION.

The DISTRIBUTION of the Coniferæ over the globe, as already stated,* is general; the order being represented everywhere where arborescent vegetation can exist, with two remarkable exceptions, already pointed out.† The modifying phrase, "wherever arborescent vegetation exists," is both necessary and important, for, besides the Arctic and Antarctic Regions where, under present conditions, no trees grow, there are large tracts both in the Eastern and Western Hemispheres that are treeless, the cause of which is, at least in part, explained by the peculiar physical circumstances that influence their climate.‡ The most extensive of these treeless regions in the Eastern Hemisphere are (1)—The Steppes of South-Eastern Europe and the great table-land of Central Asia which, together, stretch across the continent from the River Don to the confines of China. (2)—The Sahara Region, which, including the Arabian and Syrian Deserts, extends from the Atlantic Ocean to the Persian Gulf. To these may be added an extensive treeless tract in the interior of Australia. In the Western Hemisphere there are (1)—The great

* *See* page 5.

† The Indian Peninsula and Central Africa.

‡ They are not absolutely treeless, there are isolated spots and oases where springs of water are found, and around which trees have sprung up, but they are too few in number to affect the general statement.

Prairie Region of North America, and (2)—the Pampas of South America. The areas of these treeless regions form in the aggregate no inconsiderable portion of the whole surface of the land.

Reserving the statements of the separate habitats of the Tribes, Genera, and the Species contained in the Order for their respective Sections in Part II., the general distribution of the existing Coniferous vegetation may be conveniently sketched according to the Natural Floras or Regions defined by Professor Grisebach,* with some necessary modifications which the subject requires. In all such divisions, however, "there is a definiteness and sharpness of outline which is really an inherent defect," † and in the adaptation of these geographical divisions for the purpose of explaining the distribution of Coniferæ, this defect is occasionally manifest. We commence with the EUROPEO-SIBERIAN region as being that which includes the greater part of our own quarter of the globe, and which was, within historic times, almost entirely covered with forest. In this region a belt of Conifers stretches, almost unbroken, from the North Atlantic Ocean to the Sea of Ockhotsk, the belt occupying the northern limits of the region and reaching in Europe as far north as latitude 68° 10′ N., the limit of *Abies excelsa*, and in Asia to latitude 69°, the limit of *A. obovata*. This belt is composed exclusively of members of the Fir and Pine Tribe. South of this belt, much of the land has been cleared for cultivation, especially in Europe, so that the primeval forests are chiefly restricted to the mountain chains and hilly districts. On all the mountain chains within the region, there is a zone of vegetation consisting entirely of Coniferæ, both above and below which there are Coniferous trees and shrubs intermingled with plants of other orders, their proportion to the entire vegetation of the adjacent zones gradually diminishing in both directions in receding from the zone formed exclusively of Conifers. The altitude of the Coniferous zone varies with the latitude in proceeding from north to south. Thus, in Norway and Sweden, the Coniferous forests occupy the slopes of the Scandinavian mountains from the base to the snow line. On the Hartz mountains, in Germany, the Coniferous zone predominates at an elevation of about 3,000 feet; on the Carpathians, at 4,000

* *Die Vegetation der Erde nach ihrer klimatischen Anordnung.*

† Thomé's *Structural Botany*, p. 434, Editorial Note.

feet; on the Sudetic chain, at 5,000 feet; and on the Alps of Switzerland and the Tyrol, at 6,000 feet. The limit of *Pinus montana*, which grows at a higher elevation than any other European Conifer, is about 7,500 feet on the Alps and 6,000 on the Carpathians. The Juniper is frequent on the higher grounds and open downs of Europe and throughout Siberia. The Yew is common in Western Europe, especially in the British Isles. In the Mantschuria district, in the extreme east of Asia, the Siberian Conifers are confined to the mountains.*

> It is worthy of note that there is probably no country in the world of the same limited extent as England in which so many exotic species of Conifers thrive and so few are indigenous. The only native existing species are *Pinus sylvestris*, *Juniperus communis*, and *Taxus baccata*.

In the MEDITERRANEAN region the Coniferæ form a much smaller proportion of the entire vegetation than in the Europeo-Siberian region, but there are more genera and species. On the borders of the Atlantic Ocean, and in the low lands on the east side of the Bay of Biscay, *Pinus Pinaster* is common. Throughout the region the Fir and Pine tribe is confined chiefly to the mountain slopes at considerable elevations, at places forming extensive forests. The Cedar occurs on Mount Atlas, in Algeria; also on Taurus and Lebanon in Western Asia. In the extreme east, in Armenia and in the neighbourhood of the Black Sea, there are extensive forests of *Abies orientalis*. The Junipers are represented everywhere throughout the region by numerous species; the evergreen Cypress is common, and in Morocco and other parts of North Africa an allied species, *Callitris quadrivalvis*, is frequent.

> Perhaps no country in Europe has more native species than Italy, as many as twenty being included in its Flora. But although Italy contains so many species and Europe north of the Alps has but six, the number of individual trees is by no means apportioned in the same way. The Conifers in the north of Europe form immense forests, and consequently play an important part in the general aspect of the country. In Italy, on the contrary, with the exception of the Alps, where they form by their quantity, a region at the mean height, these trees constitute but small scattered woods, which give no important feature to the landscape.

* Thomé's *Structural Botany*, p. 439.

On the HIMALAYAS, the Coniferous zone occurs at a higher elevation than on the mountain ranges in higher latitudes; the altitude of the zone gradually increase in advancing from Afghanistan to Bhotan. In the north-west, the great Deodar forests cover extensive tracts at from 5,000 to 10,000 feet of elevation; these are succeeded eastwards by Pines and Firs at from 6,000 to 11,000 feet, and further east the Larch occurs with Pines and Firs at from 7,500 to 13,000 feet of elevation.* Below these altitudes, and intermixed with the trees and shrubs of other orders, the Cypress, Juniper, and Yew, are also represented by one or more species.

Referring to the distribution of Himalayan Conifers, Sir J. D. Hooker remarks † that the Deodar has not been seen east of Nepaul, nor *Pinus Gerardiana*, nor *Cupressus torulosa*. On the other hand, *Abies Brunoniana* does not occur west of the Gogra, nor *Larix Griffithiana* west of Cosi. Of the twelve Sikkim or Bhotan Conifers, ‡ nine are common to the north west Himalayas and three not, and of the thirteen natives of the north-west Provinces, five are not found in Sikkim.

In the CHINO-JAPANESE region the presence of a dense population has driven back the aboriginal Flora to the highlands. In China the limits of the distribution of the native plants are not known, but Conifers are met with in every part of the country that has been visited by Europeans, and the number of native species is considerable, including some of peculiar interest and aspect.§

In Japan the Coniferæ are still more numerous. All the tribes included in the Order are represented by several species. Jesso, the northern island, is almost entirely covered with forest composed chiefly of Firs and Pines, and so dense that it is impossible to get from one part of the island to another except by going round the coast. A remarkable feature in the Coniferæ of the Chino-Japanese region, is the existence of several genera allied to the gigantic Sequoias of California, and at the present time represented by a single species only, but which at a former epoch were

* These numbers must be taken as general expressions of the heights.

† *Himalayan Journals*, vol. i. p. 256.

‡ *Juniperus recurva, J. religiosa, J. excelsa, Abies Brunoniana, A. Webbiana, A. Smithiana, Pinus excelsa, P. longifolia, Larix Griffithiana, Cupressus torulosa, Podocarpus neriifolia, Taxus Wallichiana.*

§ Especially *Ginkgo biloba, Cunninghamia sinensis, Glyptostrobus heterophyllus, Cupressus funebris, Pinus Bungeana, Abies Fortunei.*

numerous, and were spread over a great part of the northern hemisphere.

> The richness of the Coniferous vegetation of the Chino-Japanese region, and the prolonged existence of species whose congeners in other parts of the world have long since passed away, are doubtless owing to a more regular distribution of the rainfall, combined with a high summer temperature.

The NORTH AMERICAN forest region corresponds in a great measure to the Europeo-Siberian forest region of the eastern hemisphere. "A broad forest zone passes through the whole continent from Behring's Straits to Newfoundland, and southwards as far as Florida and the mouths of the Mississippi." * The northern belt includes the zone of *Abies nigra* and *A. alba*, intermixed in the eastern portion with the Scrub, Yellow, and White Pines (*Pinus Banksiana P. inops, P. mitis*, and *P. Strobus*). Further south the Coniferous trees are mixed with broad-leaved deciduous trees, but the mountain sides and many parts of the lower grounds are covered with forests of Pine and Fir. In the swampy district that extends from New Jersey southwards, and along the river banks of the South Eastern States, the Deciduous Cypress and White Cedar are abundant; and an immense tract called the "Pine Barrens," extending for hundreds of miles along the Atlantic coast, is covered with *Pinus australis* and *P. tæda*.

The CALIFORNIAN and MEXICAN region. The maximum of Coniferous vegetation in North America is reached in the long strip of territory lying between the Rocky Mountains and the Pacific Ocean, and extending from British Columbia to beyond the Mexican line. In this region not only is the area covered by Coniferous forests very great in proportion to the entire extent, but also the trees of most of the species attain so gigantic a size, that all other kinds met with in other parts of the world, with the exception perhaps of the Indian Deodar, may be called dwarf in comparison. The number of species in this region, especially of Firs and Pines, is exceptionally great; the Cypress tribe is represented by many species; the Yew tribe by at least two; and California is well known to be the home of the gigantic Wellingtonia and Redwood.

The Coniferous forests of California are continued in the highlands,

* Thomé's *Structural Botany*, p. 446.

stretching southwards through the Mexican territory into Guatemala, but at a higher elevation. Forests of Pine cover the mountain slopes at from 9,000 to 12,000 feet of elevation, and lower down, interspersed among the trees and shrubs of other orders, the Cypress, the Juniper, and the Yew have each their representatives.

Within the TROPICS, in both hemispheres, Coniferous trees and shrubs form but a minute fraction of the entire arborescent vegetation; thet ropical species belonging to the Order are moreover unimportant compared with those of extra tropical regions. One species of Pine (*Pinus occidentalis*) occurs on the mountains of Cuba and St. Domingo, and two or three Podocarps are found within the West Indian region. In tropical South America, Podocarps are the sole representatives of the Coniferæ, but there are some species of Ephedra, a genus of Gymnospermous plants, closely allied to the Order, natives of the same region. Within the equatorial zone of South America, there are large tracts called *Llenos*, grassy plains entirely destitute of trees, and sometimes flooded by continuous rain. The Andean region is also treeless along the Pacific coast, but on the eastern slopes of the Peruvian and Bolivian Andes, vegetation is abundant, among which the only Coniferous plants are Podocarps, but the allied Order Gnetaceæ, is represented by several species of Ephedra. Tropical Africa is almost destitute of Conifers: one species of Podocarp is reported from the island of St. Thomas, off the coast of Western Africa; one of Widdringtonia in Madagascar, and the curious Welwitschia is indigenous to the Kalahari region. The Flora of the East Indian Archipelago includes more coniferous species than that of any other tropical region. *Pinus Merkusii* occurs in Sumatra, *P. insularis* in the Philippine Islands, *Dammara alba* in Borneo, Java, Celebes, &c.; *Gnetum Gnemon* is common throughout the region, and there are besides, six or seven other species of Gnetum of local occurrence.

The distribution of the Coniferæ in the SOUTHERN HEMISPHERE offers scarcely any analogy to their spread over the Northern regions, which is no more than might be expected from the peculiar configuration of the land south of the Tropic of Capricorn, its comparatively limited extent, and the separations of the principal portions from each other by an immense expanse of ocean. The Southern

Hemisphere Conifers are also separated from the Northern ones by several well defined characters both as regards their vegetation and also their reproduction,* so that no Northern genus has a representative in the South.†

In AUSTRALIA the species are numerous, but each is restricted to comparatively narrow limits. There are considerable forests of Araucaria in the neighbourhood of Moreton Bay; and scattered through the "scrub," Dammaras, Frenelas, and Podocarps are more or less frequent. In Western Australia the Actinostrobi and Frenelas are abundant. New Caledonia, botanically included in the Australian Region, is rich in Conifers—two species of Araucaria and two of Dammara are indigenous to the island; Frenelas, Dacrydiums, and Podocarps are also common. In Tasmania, where rain falls at all seasons, Conifers are also more abundant than on the mainland. Athrotaxis, a genus, including two or three species, allied to the Californian Sequoias, Fitzroya (Diselma), and Microcachrys, each including but a single species, are all peculiar to the island; and the Yew tribe is represented by Dacrydium and Phyllocladus. In New Zealand the Coniferæ attain their maximum in numbers in the Southern Hemisphere, constituting, according to Sir J. D. Hooker, as much as one-sixty-second part of the phanerogamic Flora of the colony. Here some of the members of the Cypress and Yew tribe attain the dimensions of large trees; the Incense Cedar (*Libocedrus Doniana*), the Totara Pine (*Podocarpus Totara*), and the Kauri Pine (*Dammara australis*), are among the most valuable of timber trees in the island.

The SOUTH AFRICAN region, which is situated about midway between Australia and the South American forest region, is poorer in Conifers than either; two or three species of Widdringtonia and a few Podocarps being the only plants belonging to the order found there. The Araucaria forests of Southern Brazil and the western slopes of the Andes of Valdivia are among the most remarkable features of the SOUTH AMERICAN forest regions. The Incense Cedars (two species), and Podocarps are abundant in Southern Chili; and towards the extreme verge of the continent, the Yew tribe is further

* The Dammaras, which, with the Araucarias, are the southern representatives of the Pines and Firs, have broad flattened leaves, and in both the development of the seed is on quite a different principle. Differences not less striking are observable in the other tribes.

† The *Libocedrus decurrens* of California is an exception.

represented by Saxe-Gothæa, which is found at a considerable elevation, associated with a dicecious member of the Cypress tribe (Fitzroya).

The present distribution of the Coniferæ over the surface of the globe is believed to have resulted from the gradual geological changes that have been effected since the first appearance of a Coniferous vegetation in the earlier formations; and the existing genera and species are believed to have been developed in the course of ages from those that have long since become extinct.

The evidence adduced in support of this belief consists in the fossil remains of the plants found in the different strata or rocks of which the crust of the earth is composed, and which are proved to have been formed slowly by the gradual action of water, or suddenly by mighty convulsions. It is further proved, that the distribution of land and water on the surface of the globe has not always been the same as it is now; many districts, which are now continents, having been at one time seas, and *vice versâ*; and also that the changes in climate have been not less remarkable. Similar formations and consequent changes are still in progress on a vast scale in every region of the globe by the agency of water, as is seen by the deposits of layers of mud continually accumulating at the mouths of the great rivers, as the Nile, the Ganges, Ho-ang-ho, Mississippi, &c., and which are brought down by their waters in a state of suspension or solution, and forming what are called "Deltas."

From the observed uniformity of Nature's laws and workings, it is reasonable to infer therefore, that a cause constantly operating in this way at the present time in the case of these and other rivers, has also been operating in the same way from remote antiquity. In the course of these formations, "multitudes of plants, including even large trees, have become embedded in the soft deposits of mud, and their remains preserved in the rock, which results from the hardening of the mud.* The soft and delicate parts could not be perpetuated in this manner; and it is found, in fact, that only the harder parts, like the wood-bark and fruits, are preserved. The softer portions have been, more or less, quickly decomposed; although under specially favourable conditions, there has been some preservation even of these. These delicate parts have in some instances left *impressions* in the hardening mud, from which the form, and even the species, can be recognised." †

Geologists have classified the different strata into systems, with a subdivision into groups, to which they have given appropriate names. They have also assigned to the groups a chronological order of formation, not indeed by referring them to a particular year, or number of

* It is well-known that in the Mississippi and other great American rivers, thousands of trees float annually down the streams. (Sir Charles Lyell, *Geology*, p. 481).

† Thomé's *Structural and Physiological Botany*, p. 418.

years reckoned from a fixed epoch, but from an examination of the fossil remains, and from other data, they have ascertained which strata are of earlier formation, and which are more recent. They have also shown that, from the remains of plants and animals found in the different strata, the simplest forms alone of organic life occur in the more ancient strata, and there has been a gradual developement throughout the series, from the simpler forms to the higher and more complex organisations met with in the more recent strata, among which existing species begin to make their appearance.

The oldest vestiges of the vegetable world that hav ebeen preserved, occur in the lower strata of the Primary or Palæozoic Age, called the Silurian System.* They consist only of a few marine Algæ (Seaweeds). In the Devonian System vegetable remains are more abundant. Land plants make their first appearance, and among them Coniferæ and a few Cycads. "Vegetable life had extended over the earth in a variety of forms, but the aspect of this period, as also of the next in succession, must have been uniform and monotonous to an extraordinary degree." †

In the Carboniferous period (Coal Measures), vegetation attained a luxuriance far surpassing that at present existing. Over five hundred species have been described, "which may perhaps be a fragment only of the entire flora, but they are enough to show that the state of the vegetable world was then entirely different from that now prevailing."‡ This vegetation, which formed the true primeval forests of the earth, consisted of gigantic Club Mosses (Sigillariæ, Lepidodendræ, &c.), Horse Tails, called Calamites (Equisetaceæ), and Coniferæ, with a dense undergrowth of Ferns, which in this period attained a special developement. "The Coniferous trees are referred to five genera, the woody structure of some of them showing that they were allied to the Araucaria division of Pines more than to any of our common European Firs. Many, if not all of them, differed from living Coniferæ in having large piths." The Sigillarias and Calamites appear to have been quite distinct from all tribes of now-existing plants. "That the abundance of Ferns implies a moist atmosphere is admitted; but no safe conclusion," says Dr. Hooker, "can be drawn from Coniferæ alone, as they are found in hot and dry, and in cold and dry climates, in hot and moist, and in cold and moist regions. In New Zealand the Coniferæ attain their maximum in numbers; many species of Ferns flourish there, some of them arborescent, together with many Lycopods, so that a forest in that country may make a nearer approach to the Carboniferous vegetation than any other now existing on the globe.§ The uniformity of the vegetation of the period, which it is computed must

* For the explanation of these and other terms of the like kind used in the sequel, the reader is referred to works on Geology.

† Thomé, p. 420. *See* also Sir C. Lyell's *Geology*, p. 544.

‡ Sir C. Lyell, *Geology*, p. 466. § *Idem*, 476.

have lasted at least a million of years,* is inferred from the identity of its fossiliferous remains found in different parts of the world."

In the period immediately succeeding the Coal Measures, the luxuriance of vegetation appears to have diminished. As if the earth were already exhausted, one form after another of the Carboniferous vegetation disappears. The prevalent forms in the Permian System are still Sigillariæ, Calamites, and Coniferæ of the Araucaria division; Cycads attain their maximum developement and Palms first appear.

A different vegetation characterises the Secondary or Mesozoic strata. The Coniferæ began in the Devonian, attained a maximum in the Coal Measures, again diminish in the Permian. In the Triassic System, the oldest in the series, Coniferæ and Ferns formed the main part of the forest, the principal species of the former being Voltzia and Albertia, the first a lofty tree not unlike our Cryptomeria, and the latter had broad leaves penetrated by longitudinal veins.† In the next in succession, the Jurassic system, consisting of beds of argillaceous limestone, marls, and clays called Lias and Oolite, the prevalent forms of the forests consisted of Cycads, associated with numerous Coniferæ, nearly related to our Araucarias and Thuias, of which remains have been found in the Lias at Whitby; in the inferior Oolite at Bruton in Somersetshire; and in the Purbeck beds in Dorsetshire. The underwood of the forests still consisted of Ferns along with fleshy Fungi; the Calamites had disappeared and were replaced by other Equisetaceæ (Horse tails), scarcely exceeding our own in size. In the Cretaceous System, the first Dicotyledonous trees appear, these were allied to the Walnuts, Oaks, and Figs of our Flora; Cycads diminish in number, but Coniferæ are still abundant, the most common in the upper Cretaceous period belonging to a genus called Cycadopteris and hardly separable from Sequoia (Wellingtonia), and of which both cones and branches are preserved. Species of Araucaria like those of Australia are also found associated with many Proteaceæ (Grevilleas, Hakeas, &c.), now so abundant in the same quarter of the globe.‡

The lowest of the Tertiary or Cainozoic Rocks are the Eocene. In this period Dicotyledonous trees began to contest the supremacy with Cycads and Cryptogamia. Trees allied to the gigantic Sequoias of California, the Cunninghamia and Glyptostrobus of China, which first appear in the preceding system, attain their greatest development in this and the succeeding period, the Miocene, in which remains have been found in Greenland, Iceland, Britain, Switzerland, and Italy. Pines belonging to the three-leaved section, are proved to have existed in Europe in this period. In the middle Tertiary are

* Sir C. Lyell, *Geology*, p. 489.
† Thomé's *Structural and Physiological Botany*, p. 427.
‡ Sir C. Lyell, *Geology*, pp. 426, 407, 371.

found large masses of carbon deposited in the earth in the form of beds of "brown coal," or lignite, which are almost entirely composed of Coniferous remains. "But these Coniferous forests did not exhibit a dull uniformity, as is the case with those of the present time, there was, on the contrary, an abundant and cheerful variety of forms, as is seen even now in the forests of Canada and Asia, though not to so great a degree. There must also have been enormous quantities of resin exuded by some of these trees which belonged to genera resembling Thuia and Cupressus; the resin, hardened by external conditions, being now known as amber." *

The higher we ascend in the Tertiary strata, the nearer do we find forms of vegetation approaching those now existing. In Italy has been found the remains of Ginkgo (Maiden Hair), the only present ally of which grows in China and Japan; and in the forest beds near Cromer, in Norfolk, have been found cones, foliage, and wood of *Pinus sylvestris*, *Abies excelsa*, and *Taxus baccata*, all common living species.†

The number of existing genera and species of Coniferæ has been variously estimated. The late Mr. Andrew Murray, in the *Gardeners' Chronicle* for 1866,‡ gives the following enumeration arranged according to the geographical distribution.

	Supposed Species.	Genera.
1. Europeo-Asiatic region—		
Europe	46	7
Asia, north of southern slopes of Himalayas	74	19
2. American region—		
North America, north of Panama	104	11
South America	18	5
3. Africano-Indian region—		
Africa, south of Sahara	8	2
Indo-Malayan region	14	7
4. Australian region	56	10

Reckoning Pinus, Abies, Picea, Larix, and Cedrus, as distinct genera, and Cupressus, Chamæcyparis, and Retinospora as *one*. But as several genera occur in more than one of the regions here specified, Pinus, for example, in four, Abies in three, Larix in three, Podocarpus in five, &c., it is evident that the total represents a considerable excess in the number of genera. On the other hand, the total number of species, three hundred and twenty, represents nearly the number actually known.

* Thomé's *Structural and Physiological Botany*, p. 430.
† Dr. Ramsay's *Physo-Geology of Great Britain*, p. 134.
‡ p. 634.

Henkel and Hochstetter* give the number of existing genera and species according to the following arrangement:—

Families.	Genera.	Species.
1. Araucarieæ -	1	7
2. Abietineæ - - -	7	138
Fir and Pine Tribe.		
3. Cunninghamieæ - - -	4	13
Sequoia Tribe.		
4. Cupressineæ -	18	106
Cypress Tribe.		
5. Taxineæ - - - - - -	10	79
Yew Tribe.	40	343

In this enumeration, Abies, Cedrus, Larix, and Pinus are reckoned distinct genera; Cupressus and Chamæcyparis also distinct, the latter including Retinospora; moreover, the Chinese Larch is separated from Larix and counted as a distinct genus under the name of Pseudo-Larix,† and *Juniperus drupacea* is also reckoned a distinct genus under the name of Arceuthos.

In De Candolle's *Prodromus*, Part xvi., are given descriptions by the late Professor Parlatore, of all the known genera and species in the following arrangement, the species contained under each genus, being numbered consecutively in the order of description.

Sub-tribes.	Genera.	Species.
1. Araucarieæ - - - -	2	15
2. Pineæ - -	1	113
3. Taxodiæ -	8	14
4. Cupresseæ -	12	74
5. Taxineæ - - - - -	10	92
	33	308

Pinus, Abies, Cedrus, and Larix are here reckoned as *one*; and Cupressus and Chamæcyparis distinct, the latter including Retinospora. In addition to the above; partial descriptions are also given of upwards of fifty species belonging to several genera, but which are considered doubtful.

* *Nadelhölzer*, Einleitung, p. 12.

† Following Gordon, *Pinetum*, p. 360.

SCIENTIFIC CLASSIFICATION.

The rank or position assigned to the Coniferæ in the SCIENTIFIC CLASSIFICATION of the Vegetable Kingdom now universally adopted and known as the Natural System, will be easily understood from the description of the various organs, especially those of reproduction, given in the preceding pages. It has been shown that the flowers are of the simplest possible structure, and that the fertilisation of the seed-bearing ovules takes place without the intervention of a stigma, and that the seeds are borne naked on the upper side of the woody scales of which the cone or fruit is composed. This character is also common to the Cycads and to two genera of plants called Gnetum and Ephedra, so that all the plants producing their seed in this manner have been constituted a Class or Subdivision under the name of Gymnosperma, *i.e.*, naked seeded plants. It is the absence of an ovary that mainly distinguishes the Gymnosperma from all other flowering plants, and with this is necessarily connected the difference in the mode of fertilization alluded to, and also a difference in the structure of the pollen grains.* "In their reproductive organs, therefore, the Gymnosperma exhibit a decidedly lower type of organisation than the Angiosperma (flowering plants), and in many respects occupy an intermediate position between these and Cryptogams (flowerless plants)." With the former they agree in habit, in the possession of sexes, and in their vascular tissues being complete; and with the latter they also accord somewhat in habit, the resemblance between the branchlets of some Conifers and Club-mosses being so great that Dr. Lindley could find "no obvious external character, except size, by which they can be distinguished."† There is a further analogy between Conifers and Selaginellas in the pollen of the former and the microspores of the latter.‡ In the anatomical structure of the wood, Conifers have been shown

* For the explanation of this difference, which would be too intricate to introduce here, the reader is referred to works on Structural and Physiological Botany.

† Dr. Lindley's *Vegetable Kingdom*, p. 221.

‡ Die Pollenkörner verrathen eine Verwandschaft mit den Mikrosporen der Seluginellen. Sach's *Lehrbuch*, p. 488.

to be essentially Exogens;* they have also dicotyledonous and polycotyledonous embryos, and germinate nearly in the same manner as dicotyledonous plants. Through the Cycads Conifers are related to Ferns, and more remotely to Palms; the relationship between the Cycads and the Ferns consisting in some of the species having "the gyrate vernation of the leaves of true Ferns along with the inflorescence of Conifers;" and with Palms in lengthening their trunk by a terminal bud only, and in the external resemblance of their fronds. On the other hand, Conifers are related to the higher Orders of Exogens through Gnetum and Ephedra, which are true Gymnosperms, but the former has all the appearance of a Chloranth, and the latter that of a Casuarina.†

The Coniferæ have been studied by many eminent Botanists. Among the earliest was Tournefort, who, in his *Institutiones*, published in 1717, established the following nine genera, viz., Abies, Pinus, Larix, Thuya,‡ Cupressus, Cedrus, Juniperus, Taxus, and Ephedra. Linnæus, in his *Genera Plantarum*, published in 1737, only admitted seven of Tournefort's genera, uniting Larix to Abies, and Cedrus to Juniperus. He founded the genus Ginkgo, which was changed by Smith in 1796 to Salisburia, on account of its being equally "uncouth and barbarous,"§ an innovation afterwards protested against by the elder De Candolle on the principle of checking the introduction of a multiplicity of names. Adanson, in 1763, in his *Familles des Plantes*, adopted Tournefort's genera with the exception of Cedrus, which, with Linnæus, he united to Juniperus; and he added to the Coniferæ the genera Casuarina and Equisetum. De Jussieu, in 1789, in his *Genera Plantarum*, formed the family of Coniferæ of the seven genera adopted by Linnæus, placing there Casuarina and adding Araucaria. Gaertner, in 1791, united into one group under the name of Pinus, the genera Pinus, Abies, and Larix, of Tournefort, and adopted the genera Thuja, Juniperus, Cupressus, and Taxus, as characterised by Linnæus. Solander, in 1798, indicated the Dacrydium as a new genus. Lambert published in 1803 the first volume of his magnificent work *The Genus Pinus*, the second volume of which was published in 1832, and the third in 1837. L'Héritier founded the genus Podocarpus in 1806. Salisbury published in 1807, in the *Linnæan Transactions*, some curious observations on the stigma? of the Coniferæ, and endeavoured to establish four new genera, viz., Belis (Cunninghamia), Agathis (Dammara of Rumph), Eutassa and Colymbea (Araucaria). Ventenat, in 1808,

* *See* p. 7. † Dr. Lindley, *Vegetable Kingdom*, p. 221.

‡ The orthography of the genera given in this article is that of their founders.

§ Loudon, *Arb. et Frut.*, p. 2,095.

gave a new character to the *Thuja articulata* of Desfontaines, which he named Callitris. M. Mirbel, in 1812, separated *Cupressus disticha* from the other species of that genus, and described it under the name of Schubertia, a name which has not been generally adopted because it was found that M. Richard senior had already described it under the name of Taxodium. Mirbel also added the genus Frenela. In M. Richard's *Mémoire sur les Conifères*, published in 1826, the author endeavours to establish the three groups or sections of Taxineæ, Cupressineæ, and Abietineæ, adding Phyllocladus to the first named. It is this arrangement, as modified by Dr. Lindley, in his *Introduction to the Natural System*, published in 1836,* that Loudon followed in his *Arboretum et Fruticetum*, published two years afterwards. In Dr. Lindley's arrangement, the section Taxineæ is removed from the Coniferæ, and made a separate Order under the name of Taxaceæ, a distinction which was retained through all the editions of *The Vegetable Kingdom*. Loudon's proof sheets of that portion of the *Arboretum et Fruticetum Britannicum* which contains the description of the Coniferæ, were corrected by Professor Don, who for many years had charge of the valuable Herbarium of Mr. Lambert, and who had assisted, if he did not take the chief part, in the compilation of *The Genus Pinus*. Don separated the Silver Firs from Abies, and constituted them a new genus under the name of Picea, thus adhering to the Linnæan designation of Picea for the Silver Firs, and Abies for the Spruces, which reversed the names of Pliny and the ancient Naturalists. This change was not accepted by Sir W. Hooker,† Dr. Lindley,‡ and other contemporaries of Don. He founded the genus Cryptomeria on Thunberg's *Cupressus pendula*, till his time scarcely known to Europeans except by name.§ He also added the Tasmanian genus Athrotaxis,‖ Don died in 1840, Lambert in 1842, and Loudon in the following year.

The *Pinetum Woburnense*, by Forbes, containing coloured plates and descriptions of the Coniferæ cultivated at Woburn Abbey, the seat of the Duke of Bedford, was distributed shortly after the publication of Loudon's *Arboretum*. Siebold and Zuccarini's *Flora Japonica* was published in 1842, of which a reprint of vol. ii., containing the Coniferæ of Japan was issued in 1870, with some additional information collected by Dr. Siebold during his last visit to that country. Four new genera are described in this work, viz., Sciadopytis, Thujopsis, Cephalotaxus,

* Loudon, *Arb. et Frut.*, p. 2104.

† See *Bot. Mag.*, 1853, Tab. 4740.

‡ *Gardeners' Chronicle*, 1863, p. 579, where he expresses in angry language his repudiation of the so-called genus Picea, which had been attributed to him by the Editor of the *Pinetum Britannicum*.

§ *Linn. Trans.*, xviii., p. 166.

‖ *Idem*, p. 171.

and Retinispora; the first three are considered established, but the fourth, Retinispora, being founded on characters that are either inconstant or not confined to the included species, has not been recognised by men of science.

One of the earliest contributors to the systematic Botany of the Coniferæ after Loudon's death was Endlicher (Vienna, 1804-1849), who published his *Synopsis Coniferarum* in 1847. In this work the Taxaceæ of Lindley are reunited to the Coniferæ, but divided into two tribes, Taxineæ, and Podocarpeæ, the latter including the Dacrydiums as well as the Podocarps. Endlicher made several generic changes, founded chiefly upon differences in the organs of fructification, in some instances too slight to secure their adoption by Botanists generally. He separated the Californian Red Wood and the Chinese Water Pine from Taxodium, and founded the genus Sequoia, with the former to which has since been added the Wellingtonia of Lindley, and Glyptostrobus with the latter; he also separated the African Cypress from Cupressus, calling it Widdringtonia. The propriety of these changes has been generally acknowledged. He further separated the Chinese and Chilian Thuias from the North American species, constituting the first Biota and the second Libocedrus; he also adopted the genus Chamæcyparis, of which the American White Cedar (*Cupressus thyoides*) is regarded as the type, and which Spach had previously separated from Cupressus. These changes have been but partially adopted, and the last has been altogether rejected by some eminent Botanists, notably by Dr. A. Gray.*

Dr. Lindley established the genus Saxe-Gothæa in 1850, on specimens brought home by our collector, William Lobb, and three years later he published a description of the Mammoth Tree of California,† from materials supplied to him by the same energetic explorer, under the name of Wellingtonia. Subsequent examination of the tree in its native home, and especially of the structure of the male flowers, showed, however, that this name could not, in a scientific point of view, be retained, and that the "Big Tree" is, in fact, no other than a second species of Sequoia. Dr. (now Sir) J. D. Hooker founded the genus Fitzroya in 1851,‡ on specimens brought home by H.M. surveying ship Beagle. He subsequently enlarged the Order by the addition of Diselma§ and Microcachrys,‖ two curious and rare Tasmanian Conifers. Important contributions to our knowledge of the Himalayan Conifers and the Cedars have been made by the same distinguished Botanist.¶

* *Flora of the Northern United States*, p. 473.

† *Gardeners' Chronicle*, 1853, p. 823.

‡ *Bot. Mag.*, Tab. 4616.

§ *Flora of Tasmania*, p. 353, but which has since been referred to Fitzroya by the same authority.

‖ *Bot. Mag.*, 1866., Tab. 5576.

¶ *Himalayan Journals* and *Natural History Review*, 1862.

Of the remaining genera in the Order; Actinostrobus, the West Australian Cypress, was added by Miquel;* Torreya by Dr. Arne; Lepidothamnus and Prumnopitys by Philippi.† The two last named are South American Taxads, of which the first is but little known and the Prumnopitys is synonymous with *Podocarpus andinus*.

In 1855 M. Carrière, Chef des Pépinières du Muséum d'Histoire Naturelle de Paris, published his *Traité Général des Conifères*, of which a second edition, in an improved and enlarged form, appeared in 1867. In this work botanical descriptions of all the known species and varieties are given with special minuteness; to these are added, in many instances, the author's views respecting the affinities and identification of the species described, or some interesting observations in reference to them. Directions for the propagation and culture of the species included in each genus are also given, which appear to involve much needless repetition. The purpose of the work is thus practical as well as scientific, but the plan on which it is compiled and the nomenclature adopted are not calculated to recommend it to the British reader, and still less to the British horticulturist. Genera are in some instances divided into subgenera, and the subgeneric name substituted for the generic one, so that names familiar to British gardeners are, in a manner, lost sight of, and are replaced by others scarcely known, except to the scientific reader, thus adding considerably to an already overburdened nomenclature, and further entangling the synonyomy. To quote one example—The Firs are assigned to five genera, viz., Tsuga, Pseudotsuga, Abies, Picea, and Keteleeria. Following Link, and other continental botanists, in reversing the Linnæan names of Abies and Picea for the purpose of restoring the original names of Pliny, the former of which, by an inadvertency, Linnæus had applied to the Spruce, and the latter to the Silver Fir, Carrière calls the Silver Firs, Abies, and the Spruces, Picea; the Hemlock Firs are with him, Tsuga; our Douglas Fir, Pseudotsuga ‡ and, lastly, all indication of connection with the Firs by name, disappears in the case of the remarkable species from North China, which he calls *Keteleeria Fortunei*.§ Carrière also adopts Endlicher's dismemberment of Cupressus and Thuia, enlarging Chamæcyparis with the addition of Siebold's Retinispora, and also with the Nootka Sound and Lawson's Cypress, the latter of which he calls *Chamæcyparis Boursierii*, but Siebold's Retinispora (changed to Retinospora) is retained for *R. squarrosa* and two or three others, which are now known to be only seminal varieties of well-known types.

* Late Professor of Botany at Amsterdam.

† Professor of Botany at Santiago, Chili.

‡ In this nomenclature of the Firs, Carrière is followed by Dr. Engelman, and by Mr. Bentham and Sir J. D. Hooker in their *Genera Plantarum*, the last-named authorities including Fortune's Fir in Abies.

§ See *Traité Général des Conifères*, p. 260.

Carrière's *Traité* is undoubtedly a work of great merit, and his views are generally accepted by continental horticulturists.

The publication of the first edition of M. Carrière's *Traité* was followed three years afterwards (1858) by that of the *Pinetum* of the late Mr. Gordon, which became popular, probably, more on account of its being for the time, the only work on the subject available for English readers generally, than for any other reason. As it possesses no claim to be regarded as a scientific treatise, the changes introduced into the nomenclature by the author need not be noticed here. The leading feature of the book is the alphabetical order of arrangement of the genera and species, by which it simply becomes an index for reference. Geographical and other inaccuracies are frequent throughout this work. A Supplement to the *Pinetum* was added in 1862, and a second edition of the whole appeared in 1875, in which many of the defects and errors of the first are reproduced.

In 1863 the late Mr. A. Murray gave in a complete form, *The Pines and Firs of Japan*, which had previously appeared in sections in the *Transactions of the Royal Horticultural Society*. It was compiled chiefly from specimens brought from Japan by Mr. J. G. Veitch, and from which the author was enabled to revise and correct the descriptions given in Siebold and Zuccarini's *Flora Japonica*. In the same year appeared the first part of the *Pinetum Britannicum*, an elaborate and costly illustrated folio work, projected by Messrs. Lawson, of Edinburgh, and issued by them to subscribers only. The magnitude on which the work is planned has, doubtless, been the cause of the long intervals that elapsed between the issue of the parts, and thus rendered its completion hopeless, if not impossible. The last part appeared in 1877, bringing up the whole to thirty-seven, in which only thirty trees are described—a mere fragment of the projected work. Although issued in the name of the proprietors, it is well known that the letterpress of the *Pinetum Britannicum* was from the pen of the late Mr. Andrew Murray, who also, from time to time, contributed many interesting papers on the Coniferæ to the *Gardeners' Chronicle* and to *The Garden*.

The *Nadelhölzer* of Henkel and Hockstetter was published in 1865. A scientific order of the genera, &c., is adopted in this work, but the descriptions are little else than literal translations (into German) from Gordon's *Pinetum*. A passing notice is all that is necessary for *Pinaceæ*, a Handbook of the Pines and Firs by J. E. Nelson, under the pseudonym of Senilis. Its only merit, if merit it is, is originality, which no one on perusal of a few pages will be disposed to deny to it. Quite of a different character are the highly important contributions to our knowledge of the North American Coniferæ that have been made by eminent American botanists, especially by Dr. Newberry, *Pacific Railway Report*, 1857; Dr. Asa Gray, *Address to the American Association for the Advancement of Science*, 1872; Dr. Engelmann, *Transac-*

tions of the Academy of Science of St. Louis, and others. In the following pages, we have freely availed ourselves of the information contained in these valuable papers. Within the last few years, characters, as a means of classification and identification of species, have been sought for in the anatomical structure of the leaves of the Firs and other genera. One of the earliest investigators in this direction was T. Thomas, who, in 1865, published a treatise on the subject in Dr. Pringheim's *Jahrbuch IV.* He was followed, in 1871, by C. E. Bertrand, of Paris. who gave a more elaborate paper on the subject, in 1874, in the *Annales des Sciences Naturelles.* The subject was taken up in the following year, by Dr. W. R. MacNab, in the *Proceedings of the Royal Irish Academy;* and in 1877, the same botanist published an exhaustive paper in the same journal, pp. 673-704, entitled *A Revision of the Species of Abies*, in which twenty-four species are described under Abies (Silver Firs), and five others, under Pseudotsuga, viz., *A. nobilis*, *A. magnifica*, *A. Douglasii*, *A. Fortunei*, and another under the name of *A. Davidiana*, said to be a native of Thibet, and allied to *A. Fortunei.* The same line of investigation has been pursued by Dr. Engelmann, of St. Louis, Missouri, who observes that "highly important as the microscopic investigations of the leaf are, they have sometimes been relied on too exclusively, disregarding the characters furnished by the reproductive organs."* He cites, as instances, the Pseudotsuga section of Drs. Bertrand and McNab, above mentioned.

We have purposely reserved for concluding notice, although not the latest in order of publication, the Coniferæ, in De Candolle's *Prodromus* xvi., pars. 2 (1868), by the late Professor Parlatore, of Florence, which is now generally regarded by botanists as one of the most authoritative purely scientific expositions of the Order yet published. In this work, the characters on which the tribes, sub-tribes, and genera, are founded, are chiefly, if not solely derived from the organs of fructification, the characters of vegetation being altogether subordinate and relied on in framing specific differences only. Thus, the Linnæan circumscription of Pinus is restored, and the divisions of the original genus by Link and Carrière into five and six genera, are made sectional; the dismemberment of Thuia and Cupressus by Endlicher, and others, is retained; Siebold's Retinospora is altogether rejected, the species being described under Chamæcyparis; Philippi's Prumnopitys is also rejected; the Linnæan Ginkgo (Salisburia) is restored, and a few other changes of minor importance are also introduced, as will be seen from the following synoptic table.

It is scarcely necessary to add, except for the information of those who are unacquainted with Parlatore's work, that it is one of the most valuable contributions to botanical science of late years, and that it is compiled in the Latin language.

* *Trans. Acad., St. Louis*, 1878.

PARLATORE'S CLASSIFICATION OF THE CONIFERÆ.

Tribus I.—ABIETINEÆ.

Sub-tribus I.—ARAUCARIEÆ.

1. Araucaria.

Sectio I.—Columbea.
II.—Eutacta.

2. Dammara.

Sub-tribus II.—PINEÆ.

3. Pinus.

Sub-genus 1.—Pinus.

Sectio I.—Pinea.
II.—Cembra.

Sub-genus 2.—Sapinus.

Sectio I.—Cedrus.
II.—Larix.
III.—Pseudo-larix.
IV.—Picea.
V.—Abies.
VI.—Tsuga.

Sub-tribus III.—TAXODIEÆ.

4. Cunninghamia.
5. Arthrotaxis.
6. Sciadopitys.
7. Sequoia.
8. Cryptomeria.
9. Glyptostrobus.
10. Taxodium.
11. Widdringtonia.

Sub-tribus IV.—CUPRESSEÆ.

12. Actinostrobus.
13. Frenela.
14. Callitris.
15. Libocedrus.
16. Thuya.
17. Thuyopsis.
18. Biota.
19. Diselma.
20. Fitzroya.
21. Chamæcyparis.
22. Cupressus.
23. Juniperus.

Tribus II.—TAXINEÆ.

24. Dacrydium.
25. Phærosphora.
26. Lepidothamnus.
27. Saxe-Gothæa.
28. Phyllocladus.
29. Taxus.
30. Cephalotaxus.
31. Torreya.
32. Ginkgo.
33. Podocarpus.

Sectio I.—Nageia.
II.—Eupodocapus.
III.—Strchycarpus.
IV.—Dacrycarpus.

Since the foregoing article was written, a new scientific arrangement of the Coniferæ has been published by Mr. Bentham and Sir J. D. Hooker in their *Genera Plantarum*, vol. iii., pars. 1, which differs considerably from that of Parlatore, and involves many changes in the nomenclature. The most important of these changes will be noticed in their respective places in the following pages.

PART II.

SYNOPSIS

OF

GENERA, SPECIES, AND VARIETIES.

THE Order Coniferæ includes the following Tribes and Genera, omitting those of the latter unsuitable for cultivation in the open air in Great Britain. Tribes II. and III. correspond nearly to the Sub-tribes Taxodiæ, and Cupresseæ of Parlatore in De Candolle's *Prodromus*, Pars. xvi.

I. ABIETINEÆ—The Fir and Pine Tribe.

1. Abies—The Fir.
   (*a.*) Piceæ—The Spruce Firs.
   (*b.*) Sapini—The Silver Firs.
   (*c.*) Tsugæ—The Hemlock Firs.
2. Làrix—The Larch.
3. Cèdrus—The Cedar.
4. Pinus—The Pine.
   (*a.*) Binæ—Leaves two in a sheath.
   (*b.*) Ternæ—Leaves three in a sheath.
   (*c.*) Quinæ—Leaves five in a sheath.
5. Araucària—The Chili Pine.

II. Taxodiæ—The Deciduous Cypress Tribe.

1. Sciadòpitys—The Umbrella Pine.
2. Wellingtònia—The Mammoth Tree.
3. Sequòia—The Californian Red Wood.
4. Taxòdium—The deciduous Cypress.
5. Glyptostròbus—The Chinese Water Pine.
6. Cryptomèria—The Japanese Cedar.
7. Cunninghàmia.
8. Athrotàxis—The Tasmanian Cypress.

III. Cupressineæ—The Cypress Tribe.

1. Cuprèssus—The Cypress.
2. Retinòspora—The Japanese Cypress.
3. Biòta—The Chinese Arbor Vitæ.
4. Thùia—The Arbor Vitæ.
5. Thuiòpsis—The Japanese Arbor Vitæ.
6. Libocèdrus—The Incense Cedar.
7. Fitzròya—The Patagonian Cypress.
8. Juníperus—The Juniper.
   (*a.*) Oxycedri—The common Junipers.
   (*b.*) Sabinæ—The Savin Junipers.
   (*c.*) Cupressoideæ—The Cypress-like Junipers.

IV. Taxineæ—The Yew Tribe.

1. Tàxus—The Yew.
2. Cephalotàxus—The Chinese Yew.
3. Tòrreya—The fetid Yew.
4. Ginkgo—The Maiden-Hair Tree.
5. Saxe-Gothæa—Prince Albert's Yew.
6. Prumnòpitys—The Plum-fruited Yew.
7. Podocàrpus.

Tribe 1.—ABIETINEÆ—The Fir and Pine Tribe.

All the species belonging to the Fir and Pine tribe are trees with erect trunks, regularly furnished with branches from the base to the summit, which gradually contract in length from the bottom upwards; the trees, therefore, present a strictly pyramidal or conical outline during the period of active growth, which is generally very rapid up to the time of their maturity. As they become older, the lower branches, which very rarely attain a timber-like size, as in many deciduous broad-leaved trees, die off. Their duration, however, depends much on the situation of the tree; if standing solitary, the lower branches are persistent many years; but when a number of trees are standing close together, the lower branches are thrown off at an early period.

In the former case, the persistency is favoured and prolonged by free exposure to the air; in the latter, the throwing off is hastened by the exclusion of it. The height of the trunk is influenced by the persistency of the branches; while these remain in health and vigour, the trunk increases in height less rapidly than when the lower branches are thrown off in the early life of the tree. Hence it is evident, that in planting trees of the Fir and Pine tribe for ornamental purposes, they should have a *greater* space assigned to them than the area usually covered by the spread of their lower branches; but if planted for the sake of their timber, or to secure straight erect trunks as free from knots and protuberances as possible, they should be planted not much farther apart than is sufficient to allow their roots to take a firm hold in the soil.

In their maturity, the Firs, Larches, and Araucarias divested of their lower branches, are trees with thin spiry tops; the Pines and Cedars, in their old age, form rounded tops by the branches near the summit becoming thickened, and by the leader gradually ceasing to ascend. In Abies the bark is never very thick or tough, but in several species of Pinus, *P. pinea* for example, it becomes, on the contrary, very thick, rigid, cracked, and deeply furrowed; in other species, as the Scotch Pine, it takes a reddish tinge, and in the Lace-bark Pine of China (*P. Bungeana*), and also Captain Gerard's Pine (*P. Gerardiana*), it is grey or milky white, and peels off like that of the Birch or Arbutus. Aged

Pines are among the most picturesque objects in park and landscape scenery.

The geographical distribution of the ABIETINEÆ is almost co-extensive with that of the whole Coniferous Order in the northern hemisphere. The Pines are met with everywhere in both the eastern and western continents between the Equator and the Arctic Circle, except in Central Africa, India, the Tropical Islands of the North Pacific Ocean, and the treeless regions already mentioned.* South of the Equator, the Pine has never been found in a wild state, but it is becoming naturalised at the Cape of Good Hope, and in some parts of Australia and South America. Of the genus Abies, the Spruce Firs are spread over the northern portions of both continents, reaching a high latitude, but rarely extending further south than the fortieth parallel. *Abies Smithiana,* the Himalayan Spruce, is an exception, but this tree is always found at from 7,000 to 11,000 feet of elevation. The Silver Firs chiefly occupy a zone of variable width south of the Spruces, rarely reaching high latitudes, *A. Sibirica* being the only exception, nor extending further south than latitude 30° N. in the eastern continent; but in Mexico *A. religiosa* is found at a high elevation as far south as the fifteenth parallel. The Tsuga or Hemlock Firs have their largest area of distribution in America, where they are spread over the whole continent, from the Atlantic to the Pacific, between latitudes 35° and 55° north. In the eastern continent, they are, so far as at present known, restricted to two localities of limited extent in Asia, viz.—Japan and Nepaul. The Cedars are confined to three distinct and almost equidistant regions in the great series of mountain chains that stretch across the eastern continent between latitudes 30° and 35° N, from Morocco to the confines of China. The Larch is a northern tree whose area of distribution coincides pretty nearly with that of the Spruce Firs. The Araucarias and Dammaras are the representatives of the Firs and Pines in the southern hemisphere, the former in South America, Australia, and some of the adjacent islands; the latter in Australia, New Zealand, the East Indian Archipelago, and some of the South Sea Islands.

The ABIETINEÆ are "social" trees; they form forests covering

* *See* page 37.

immense areas in plains, in valleys, and on the sides of mountains, often reaching the limits of perpetual snow in the higher ranges, and covering the summits of those of lower elevation. Several of the species are spread over a great extent of country, and are found under many different conditions of altitude, climate, soil, and aspect; it is not surprising, therefore, that variations from a fixed type should be often met with. Such is actually the case, and many of the varieties, when first discovered, have been named as new species. This has been one fruitful cause of the numerous synonyms that have found their way into the nomenclature of Coniferous trees. Besides the varieties that can be referred to local influences, as those above-named, others are produced by another cause already alluded to, the polymorphous tendency which is manifested, more or less, in every tribe of the Coniferæ,* and which occurs most frequently in kinds brought under cultivation. It is much less prevalent among the Abietineæ than in the other tribes; it is, perhaps, most common in some of the Araucarias, but among the Firs are found some remarkable instances, as *Abies excelsa inverta* and *A. pectinata pendula*. It is much more rarely observed among the true Pines, and there are but few very striking departures from the usual type among the Cedars and Larches.

I.—ABIES (*Tournefort*) THE FIR.

The most obvious characteristics of the Firs are—The habit is regularly pyramidal or conical; the branches are produced in whorls; they are frondose or flat, and furnished with a profusion of foliage, which is evergreen; the leaves arise singly from the branchlets, and not in bundles of twos, threes, or fives, as in the Pines, nor fasciculated as in the Larch and Cedar; the catkins are produced along the branchlets singly, or in twos and threes, and not in clusters as in many of the Pines; the cones are cylindrical or but slightly tapering, obtusely pointed both at the base and apex, having brown scales either deciduous or persistent, coriaceous in texture, not umbonate, and which never become consolidated into the hard ligneous persistent fruit like the cones of many of the Pines. The cones attain maturity in one season.

* *See* page 28.

The Firs are highly ornamental trees. In the landscape their formal but elegant outline and dark aspect afford a strong contrast to the more irregular outline and light foliage of the broad-leaved deciduous trees. As single specimens for the lawn or park, the most eligible as well as the most admired subjects are found among the Silver Firs. Most of the Spruce Firs are highly valued for their timber, and some members of the tribe yield in their secretions resinous products of various economic uses.

The Firs admit of a division into three Sections, the species belonging to each possessing some common feature in habit, foliage, &c., distinct from the species included in the others. As a separate and different degree of importance is attached to each of the Sections in the practical operations of planting, it will be convenient to adopt the division into Sections in this place, taking them in the following order:—

I. *Piceæ*—The Spruce Firs.
II. *Sapini*—The Silver Firs.
III. *Tsugæ*—The Hemlock Firs.

There are two species which cannot strictly be placed in either section. The Douglas Fir, which, on account of its great size, general aspect, and for the valuable timber it affords, would be popularly classed with the Spruces, is, nevertheless, more closely allied to the Tsuga or Hemlock section. The Foo-chow Fir, discovered by Mr. Fortune in north China, is anomalous; having some of the characters of the Silver Firs, it also has others indicating affinity with the Spruces.

Abies is the Latin name of the common Silver Fir (*A. pectinata*); its derivation from ἄπιος (apios), a Pear tree, is hypothetical.

Section I.—Piceæ. The Spruce Firs.

The Spruce Firs, of which the common Spruce (*Abies excelsa*), may be taken as the type, form a well-defined group among Coniferous trees, easily recognised by their conical or pyramidal habit and dense foliage. They are distinguished both from the Silver and from the Hemlock Firs—

By their leaves, which are acicular or needle-shaped, more or less distinctly tetragonal or four-angled, with a prominent

decurrent cushion at their base,* and sharply pointed at the apex, scattered over the stems, or spirally arranged around them.

They are further distinguished from the Silver Firs—

By their cones, which have a more or less elongated ovoid form, and are pendulous with their scales, persistent on the axis after the seed is shed.

Inhabiting generally the northern portion of the temperate zone, the Spruce Firs are among the hardiest, as they are in some respects among the most useful of trees. Less striking in appearance than many of the Silver Firs, and, therefore, generally held in less esteem as ornamental trees, they are of far greater economic value, both on account of the quality of their timber and for the many purposes of utility for which some of the species are planted. The common Spruce of Europe (*A. excelsa*) and the Black Spruce of America (*A. nigra*), are the most important timber trees known in their respective regions. From the former is obtained annually an enormous supply of white deal used in this country and in other parts of Europe; and from the abundance and cheapness of the timber afforded by the latter, it is more used by the colonists of British North America and the adjoining districts of the United States than that of any other Coniferous tree.

The following Table includes all the Spruce Firs at present known.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES AJANÈNSIS (*Fischer*)	*Abies Alcoquiana* (Hort.) ,, *Sitchensis* (Koch) *Picea Jezoensis* (Maximowicz)	...	Japan	25 to 50
ALBA (*Michaux*)	*Pinus alba* (Lambert) *Picea alba* (Carrière) *Abies laxa* (Koch)	The White Spruce	North America	25— 50

* Technically called the *pulvinus*. It is the pulvini with the remains of the short footstalks of the leaves, that give the bark of the branches of Fir trees its rough surface when the leaves are shed.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES Alcoquiàna (*Veitch*)	*Pinus Alcoquiana* (Parlatore) *Picea Alcoquiana* (Carrière) *Abies bicolor* (Maximowicz) ,, *aciculàris* (Hort.)	Sir Rutherford Alcock's Fir	Japan	90—120
Engelmànni (*Parry*)	*Pinus commutata* (Parlatore) *Picea Engelmanni* (Carrière)	Engelmann's Spruce	Rocky Mountains	60—100
,, glauca (*Hort.*	*Abies Parryana* (Hort.) *Picea pungens* (Hort.)			
excèlsa (*De Candoll.*)	*Pinus Abies* (Linnæus) ,, *excelsa* (Lambert) ,, *Picea* (Parlatore) *Abies Picea* (Miller) *Picea excelsa* (Link) *Abies communis* (Hort.)	The common or Norway Spruce	Europe	75—130
,, Clanbrasiliàna (*Loudon*)	*Abies Clanbrasiliana* (Hort.)	Lord Clanbrasil's Spruce	Garden variety ..	3 to 5
,, èlegans (*Hort.*)	,, *compacta* (Hort.) ,, *excelsa dumosa* (Hort.)	...	,, ,,	4— 6
,, Finedonènsis (*Hort. Paul*)	,, *Finedonensis* (Hort.)	The Finedon Hall Spruce	,, ,,	
,, Gregoriàna (*Hort. Paul*)	,, *Gregoryi* (Hort.)	Gregory's Spruce	,, ,,	2— 3
,, invèrta (*Hort. Smith*)	,, *inverta* (Hort.)	The Weeping Spruce	,, ,,	
,, monstròsa (*Loudon*)	,, *horizontalis* (Hort.)	...	,, ,,	
,, pùmila glàuca (*Hort*)	... ...	...	,, ,,	3— 5
,, pygmæa (*Loudon*)	,, *nana* (Hort.) ,, *minima* (Hort.)	The Dwarf Spruce	,, ,,	2— 4

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES Glèhnii (*Schmidt*)	... ...	...	Islands of Yesso and Saghalien	20— 30
Jezoènsis (*Siebold*)	*Pinus Jezoensis* (Antoine) *Picea Jezoensis* (Carrière) *Pinus Menziesii* (Parlatore)	The Jesso Fir ...	Northern Japan	80—120
Maximowìczii (*Neumann*)	*Picea Maximowiczii* (Regel)	Maximovicz' Fir	Mantschouria	
Menzièsii (*Loudon*)	*Pinus Menziesii* (Douglas) *Abies Sitchensis* (Lindley) *Picea Menziensii* (Carrière)	Menzie's Fir ...	N. W. America	50— 70
nìgra (*Michaux*)	*Pinus nigra* (Lambert) *Picea nigra* (Carrière)	The Black Spruce	N. E. America	50— 80
obovàta (*Loudon*)	*Pinus obovata* (Antoine) *Picea obovata* (Carrière)	The Siberian Spruce	Siberia	50— 80
orientàlis (*Tournefort*)	*Pinus orientalis* (Linnæus) *Picea orientalis* (Link) *Abies Wittmanniana* (Hort.)	The Eastern Spruce	Armenia ...	50— 70
polìta (*Siebold and Zuccarini*)	*Pinus polita* (Parlatore) *Picea polita* (Carrière)	...	Japan	80—100
Schrenkiàna (*Lindley*)	*Pinus obovata Schrenkiana* (Parlatore) *Pinus Schrenkiana* (Antoine) *Picea Schrenkiana* (Fischer)	Schrenk's Spruce	The Altai Mountains and Turkestan	60— 80
Smithiàna (*Wallich*)	*Pinus Smithiana* (Lambert) ,, *Khutrow* (Royle) *Picea Morinda* (Link) *Abies Khutrow* (Hort.) ,, *Morinda* (Hort.)	The Himalayan or Indian Spruce	The Himalayas	100—150

Abies Ajanensis.—A Spruce Fir, resembling the common European species, but of more elegant habit. In its native country, it is a pyramidal tree of variable height, according to soil and situation. In British gardens, it may be recognised by the following characters:—The bark of the young shoots is pale yellowish-brown, marked with oblong, smooth, prominent cushions; the leaves are spirally arranged, but on the side shoots "twisted at the base so as to be all in the same horizontal plane; on the upper surface appressed, parallel to the direction of the branch; all flattish, rather obtuse, dark shining green three-ribbed on the outer surface, very glaucous and one-ribbed on the side turned from the light." * The cones are small, oblong tapering bodies, from 1 to 2 inches long, with undulated scales, notched at the free edge.

Habitat.—Japan (Nippon and Yesso), also the region of the Amour and Kamtchatka.

Introduced in 1861, by Mr. John Gould Veitch.

Abies Ajanensis microsperma.—Dr. Lindley gave the name of *A. microsperma* to a Spruce Fir, discovered by Mr. J. G. Veitch, near Hakodati, in Yesso. By Parlatore, De Candolle's *Prod.*, xvi., p. 418, this Fir is referred to the North American species, *A. Menziesii*, but Dr. Masters now identifies it as a variety of *A. Ajanensis*. It is a dense medium-sized tree, with smaller leaves than *A. Ajanensis*.

Abies Ajanensis has hitherto been known in nurseries and gardens under the name of *A. Alcoquiana*. "This has arisen from the fact that Mr. J. G. Veitch was not himself able to collect seeds—the country not being then open to foreigners—consequently, he had to depend on others, whose incompetence or veracity, or both, might not have been trustworthy. In any case, it is clear that the seeds got considerably mixed." As an ornamental tree in this country, *A. Ajanensis* will take a high rank. Its growth is rather slow, especially during the first four or five years from the seed, during which time it frequently shows a tendency to produce rival leaders, which should be reduced to one when observed.

The specific name *Ajanensis* is derived from Ayan or Ajan in Kamtchatka.

Abies alba.—A tree of medium size, varying in height from 25

* Dr. Masters, in *Gardeners' Chronicle*, vol. xiii., p. 115. We take this opportunity of expressing our warmest acknowledgments to Dr. Masters for the important services he has rendered by his investigation of the Japanese Abies; the result of which he has published in a series of papers in the *Gardeners' Chronicle*, from November, 1879, to March, 1880. We have, in the following pages, freely availed ourselves of the valuable information contained in these papers.

to 50 feet, but at its northern limit, a low scrubby bush. When standing singly, it has a conical outline, and is well furnished with branches from the ground; the foliage is lighter in colour than that of the common Spruce, and slightly glaucous; the leaves are short, rigid, and thick-set, covering the stem all round and appressed to it. The cones are small, being not more than 1 or 1½ inch in length, and about half-an-inch in diameter.

Habitat.—British North America, the New England States and the State of New York. It is most abundant in Canada, New Brunswick, and the adjoining provinces; northwards it occurs more sparingly.

Introduced into England by Bishop Compton about the year 1700.*

The White Spruce is one of the hardiest of trees; it is useful in ornamental and landscape planting generally, especially in situations where other less hardy Coniferous trees would not live. As a timber tree, it is of little value. "The wood is inferior in quality to that of any of the Spruces. The fibres of the roots macerated in water are very flexible and tough, and were used by the Canadian Indians to stitch their canoes of birch bark. The rate of growth of *Abies alba* in this country is from 12 to 15 feet in ten years in light moist soils, but it is slower in dry soils and exposed situations; it attains its full size in about thirty years, after which it soon begins to show signs of decay; it is comparatively a short-lived tree." †

The specific name *alba*, "white," has a relative meaning only, and was given in contradistinction to *Abies nigra*, with which it is frequently found associated.

Abies Alcoquiana is one of the finest representatives of the Spruce Firs in Japan, where it is a lofty pyramidal tree, from 90 to 120 feet high. In its maturity, the upper branches frequently lengthen and become much ramified, so that the tree then has a dense rounded head. The leaves are rigid, more or less curved, distinctly four-sided, flattened, sharply pointed at the tips, and slightly glaucous on the two under sides. The cones are oblong, tapering at both ends, from 2 to 3 inches long, with brown, shining striated scales, slightly rounded, and minutely toothed on the free edge.

* Loudon, *Arb. et Frut.*, p. 2312. Many of the dates of introduction given in the sequel are derived from the same authority.

† *Idem.*

Habitat.—Fusi-yama, in the island of Nippon, Japan, at 4,000 feet elevation.

Introduced by Mr. J. G. Veitch in 1861.

Not much is known respecting the quality of the timber of this fine tree, but Mr. J. G. Veitch has inserted in the MS. Notes of his "Tour in Japan" that it is good, and that many trees are annually felled for building and other purposes.

Abies Alcoquiana differs from *A. Ajanensis* in its more rapid growth, its less rigid branchlets, in the form and structure of the leaves, the lighter colour of the foliage, and in the more rounded and less deeply-toothed cone scales. It is a handsome and stately tree, one of the best of the Spruces for ornamental planting.

Whether Siebold's *Abies Jezoensis* belongs to *A. Ajanensis* or to *A. Alcoquiana* cannot yet be decided with certainty. While the leaves are spine-tipped, and not unfrequently as four-sided as those of *A. Alcoquiana*, the cones brought by Mr. Maries from Yesso may be pronounced identical with those of *A. Ajanensis*. The Yesso tree, Mr. Maries informs us, is quite distinct both in habit and aspect from either, whatever may be its botanical affinity, and we have, therefore, provisionally retained it as distinct.

Abies Alcoquiana was named by Mr. J. G. Veitch in compliment to Sir Rutherford Alcock, British Minister at Yedo at the time of his visit to Japan, and through whose kindness he was enabled to make the trip to Fusi-yama, where this and other fine Conifers were first discovered.

We regret to have to state that two distinct forms have been distributed by us under the name of *Abies Alcoquiana*. The cause of this error has been already referred to in the description of *A. Ajanensis*, the second of the two species hitherto called *A. Alcoquiana*. Besides the error of distributing the two species under one name, there has also arisen a further confusion in the nomenclature and published botanical descriptions, which is fully discussed by Dr. Masters in his recent paper in the *Gardeners' Chronicle*, vol. xiii., p. 212.

Abies Engelmanni.—"In its most favourable localities, this species makes a stately tree from 80 to 100 feet high, forming a narrow sharply-tapering spire of a rather darkish hue; on higher altitudes, it is a smaller nearly round-topped tree, very much branched; on the highest summits, a prostrate and almost creeping shrub. The wood is white and soft, neither knotty nor resinous, and, therefore, esteemed for inside carpentery. The leaves are variable, stouter than they usually are in *A. alba* or *A. nigra*,

but less so than in *A. Menziesii*. Cones small, from 2 to 2½ inches long."

Habitat.—The slopes of the Rocky Mountains from New Mexico to the head waters of the Columbia and Missouri Rivers, occupying in Colorado a belt between the limits of 8,000 and 12,000 feet elevation.

Introduced into England in 1864.

The foregoing particulars are taken from a description of the tree by Dr. Engelmann, published in the *Transactions of the Academy of Science of Philadelphia*, and reprinted in the *Gardeners' Chronicle* for 1863, p. 1,035.

Since its introduction into Great Britain, *Abies Engelmanni* has proved perfectly hardy. The young plants are distinct, having their branches horizontal and stiff, very thickly covered, especially on the upper side, with robust rigid sharply-pointed slightly-recurved leaves, more distinctly quadrangular than those of any other American species. In colour, the foliage is rather a deep green with much less glaucescence than is seen in *A. Menziesii*, to which it appears to be nearly allied.

The specific name was given by Dr. Parry, an American botanist, in compliment to Dr. Engelmann, its discoverer, also a botanist and physician of St. Louis, Missouri, U.S., and author of several valuable papers on the North American Coniferæ.

Abies Engelmanni glauca differs from the type only in the colour of its foliage, in which the natural green of the species is merged by glaucescence into a bluish-grey. A strikingly beautiful tree.

This variety is the most ornamental of all the American Spruces; its remarkable colour and regular outline render it one of the best of Conifers for the lawn.

Abies excelsa.—The common or Norway Spruce. Being more frequently planted in this country for purposes of utility than for ornament, its fine proportions are not often seen to advantage; it is, however, under conditions favourable to its development, one of the handsomest of Conifers for the decoration of the park and landscape. When standing singly, and till it has reached its maturity, its lofty trunk is feathered with branches from the base to the summit, the lower ones decumbent by the weight of their numerous branchlets, those higher up being horizontal, while

the uppermost whorls are slightly inclined upwards. The aspect of the tree is somewhat sombre on account of its dense foliage, which is lighter or darker in colour according to the soil and situation in which the tree is growing. The height of the tree is also influenced by similar conditions, and varies from 75 up to as high as 125 feet, and even more before the period of decay sets in.

Habitat.—Europe, from the limits of arborescent vegetation in the north at about latitude 68° to as far south as the Alps and Pyrenees. With the exception of the last-named mountains, on which it is not very abundant, it is not known to be native south of latitude 45°, and it is not indigenous to Denmark, Holland, Britain, and Ireland.

Introduced into England at a very early period. It is mentioned in Turner's *Names of Herbs*, published in 1548.

The varieties of the Common Spruce are very numerous, some of them showing remarkable deviations from the usual type in their manner of growth. The following are among the most distinct:—

Abies excelsa Clanbrasiliana.—A low compact round bush, seldom seen higher than 3 or 4 feet. The original plant is said to have been found on the estate of Lord Clanbrasil, at Moira, near Belfast.

Abies excelsa elegans.—A dense shrub of neat habit, growing from 5 to 7 feet high. The branches are very short, and the leaves more erect than in the common form.

Abies excelsa Finedonensis shows an unusual change of colour in the young shoots, which, when first formed, are pale yellow, gradually changing to brown, and finally assuming the normal colour of the species.

It originated at Finedon Hall, Northamptonshire.

Abies excelsa Gregoryana is one of the dwarfest of the varieties of the common Spruce. It has small spreading branches clothed with short stiff leaves placed obliquely round the shoots.

It originated in the Cirencester Nurseries.

Abies excelsa inverta is a pendulous form in which the branches

droop almost close to the trunk; the leaves are somewhat larger and of a brighter green than those of the type.

It originated in the Nurseries of Mr. Richard Smith, at Worcester.

Abies excelsa monstrosa.—In this variety the strength of the plant seems to be expended in the formation of the trunk and principal branches at the expense of the other parts; the branches are long and straggling, almost without laterals, and covered with short bristly leaves. It has a singularly grotesque appearance.

Abies excelsa pumila glauca.—A handsome dwarf form, with deep green glaucescent foliage; the leaves are nearly erect on the branches.

Abies excelsa pygmæa is a diminutive pyramidal bush, having all its branches excessively shortened, with their parts proportionately diminished.

The economic importance of the common Spruce is doubtless unsurpassed by that of any other northern tree. Its timber possesses every quality that renders it valuable for constructive purposes, both for building and for articles of every day use. Its only available competitor is, perhaps, the Scotch Pine, but the wood of that valuable tree is coarser in texture, and much more resinous. *Abies excelsa* yields the white deal of commerce, of which the finest is supplied from the great forests of Norway and Sweden, where, owing to climatal causes, it attains its greatest perfection. The bark of the Spruce Fir may be used for tanning, but it is inferior in this respect to that of the Larch, although superior to that of the Scotch Pine.* Excellent cordage is made in Norway of the fibres of the roots. Specimens of this cordage sent to the London Exhibition of 1862 showed that it is not inferior in tenacity and strength to the best ropes made of hemp and other material.

The Spruce Fir is much planted for purposes of utility. It is one of the best of *nurses* for other trees; its perfectly hardy constitution, dense habit, and rapid growth, render it capable of affording efficient protection to less hardy trees during their earlier stages of growth. It is also one of the best of trees for forming a permanent screen for protection from piercing winds, for hiding unsightly buildings, and for shutting out of view incongruous objects in the landscape. Its frond-like branches form an excellent protection for the blossoms of fruit trees on walls from spring frosts, and are often used as such by

* *Pinetum Britannicum, Abies excelsa*, p. 12.

gardeners in the absence of other accommodation; they are also useful for protecting tender plants against walls or in the open ground. The Spruce Fir bears the shears well, and makes excellent hedges for shelter; but it is surpassed in this respect by other Coniferous trees, and it is therefore not used as a hedge plant in Great Britain; but Spruce hedges are not uncommon in Switzerland, Bavaria, and the Carpathian regions.

The Spruce Fir will grow in almost any soil, and in any aspect. Very dry soils are, however, unfavourable for it; its growth is then comparatively slow, its foliage is less persistent, and its appearance is bare and thin. Retentive soils, such as clays and loams, and where the roots can receive plenty of water, are the best for it; it may even be planted in peat soils where the drainage is sufficient to prevent water becoming stagnant at the roots.* The rate of growth of the Spruce Fir in this country, under ordinary conditions, "is nearly as great as that of the Scotch Pine; for three or four years at first, it does not average a growth of more than from 6 to 8 inches a year; but after the plants are 3 feet high, and till they attain a height of 50 feet, the rate of growth is from 2 to 3 feet a year. In ten years from the seed, the plants will attain a height of 12 or 15 feet in the climate of London, and in fifty years a height of from 90 to 100 feet."†

The specific name *excelsa* was substituted by Lamark for the Abies of Linnæus, in reference to the Spruce being the tallest of European trees; this name was adopted by the elder De Candolle,‡ and has since been generally but not universally accepted. The Norway or common Spruce was the *Picea* of Pliny;§ it is the *Gemeine Fichte* or *Rothtaune* of the Germans, the *Pesse* or *Sapin rouge* of the French, the *Abeto rosso* or *Abeto di Germania* of the Italians.

Abies Jezoensis.—A tall, fast-growing, slender tree, with a tapering trunk, sometimes attaining a height of from 120 to 150 feet in the forests of Yesso. The branches and their ramifications are somewhat slender, horizontal, or slightly decumbent, and the branchlets elegantly pendulous, and clothed with sharp-pointed needle-like bright green leaves, with a prominent mid-rib on both sides, close-set and spirally arranged round the stem. The cones are cylindrical, from 2 to 2½ inches long, and 1 inch in diameter, obtuse both at base and apex, pendulous, and produced at the extremities of the branchlets; the cone scales are undulated and erose at the free edge, like those of *A. Ajanensis*.

* *Pinetum Britannicum*, *Abies excelsa*, p. 15.

† Loudon, *Arb. et Frut.*, p. 2297.

‡ *Fl. Fr.* III., 275, *ex* Carrière.

§ *Hist. Nat.*, XVI., 10.

The specific name, *Jezoensis*, refers to the habitat. This tree should not be confounded with the Foo-chow Fir, introduced by Mr. Fortune, of which there are specimens cultivated in gardens under the name of *Abies Jezoensis*.

Habitat.—The island of Yesso, northern Japan.

Introduced in 1879 through our collector, Mr. Maries.

Abies Menziesii is a tall strict tree, attaining its largest size near the mouth of the Columbia River. Its branches are regularly whorled, somewhat stiff, and clothed with foliage by which this species may be readily distinguished from all other Abies. The leaves are slender, rigid, and sharp-pointed, light green above, and marked by two silvery lines beneath; those above being nearly erect, those below pointing laterally in two directions. The cones are small, rarely exceeding 3 inches in length.

Habitat.—North-west America, in the neighbourhood of the Pacific coast, from about latitude 42° N. in California, to as far north as latitude 67° in British Columbia.*

Introduced, in 1831, by the Horticultural Society of London, through their collector, David Douglas.

In Oregon and Washington territory, *Abies Menziesii*, in company with *A. Douglasii* and *Thuia gigantea*, is one of the principal trees that forms the dense coating of vegetation that covers the coast range of mountains, but it never attains dimensions so gigantic as those of *A. Douglasii*. Its timber is of excellent quality, and is used by the settlers for various kinds of carpentry.† In Britain the growth and appearance of *A. Menziesii* are much influenced by the soil and situation in which it is planted; "it will not thrive in light dry soils; in such places it becomes half deciduous in very dry seasons, and hence very unsightly."‡ Deep, loamy, and moist soils, in such as it attains its greatest perfection in its native country, are also the most suitable for it in Great Britain, and when planted in them it grows rapidly into a fine well-furnished tree, and the silvery glaucous hue of its foliage is beautifully developed. To secure good specimens of *A. Menziesii*, a space having a radius of not less than 20 feet must be allowed for it, as the lower branches of some of the finest in England have attained that length.

* Parlatore adds, "In Siberia orientali, Davurica, Kamptchatka et in Japoniæ insulis borealibus Jezo et Karafto et culta in hortis circa urbem Jeddo," thus including under *A. Menziesii* the *A. microsperma* of Lindley.

† Dr. Newberry's *Pacific Railway Report.*

‡ Mr. Fowler in *Gardeners' Chronicle*, 1872, p. 76.

The specific name *Menziesii* was given by Douglas in compliment to Mr. Archibald Menzies, the indefatigable Scotch botanist, who accompanied Vancouver on his voyage of discovery in 1790, during which this tree was first discovered. Although Mr. Menzies' scientific labours were not especially directed to the investigation of the Coniferæ, his name has become prominent in connection with them as the introducer of *Araucaria imbricata* into British gardens; he was also one of the first who made known the existence of the gigantic Coniferous vegetation of north-west America, and thus led the way to the important discoveries of Douglas, thirty-five years later. The following is a brief sketch of his life:—

ARCHIBALD MENZIES was born at Weims, in Perthshire, on the 15th of March, 1754, and died in London on the 15th of February, 1842. He was early placed in the Botanic Garden at Edinburgh, and, through the assistance of Dr. John Hope, Professor of Botany, he was enabled to prosecute his studies so as to take the diploma of surgeon. In 1778, he made a tour through the Northern Islands for the purpose of collecting plants for the Botanic Garden. He then went to Carnarvon to assist a medical man, and he finally became assistant-surgeon in the Navy. He visited Halifax, Staten Island, the Sandwich Islands, China, and north-western America. In 1790, he accompanied Vancouver on his celebrated voyage; he visited King George's Island, the south coast of New Holland, and part of New Zealand, Otaheite, and the north-west of America. He returned to England in 1795. He made large collections of plants, as well as of other objects of Natural History during these voyages. Many of them were new, and have been described by Smith, Brown, Hooker (Sir W.), and others. He afterwards served in the West Indies. About the beginning of the century he quitted the Navy, and passed the remainder of his days in the vicinity of London. His collection of plants was left to the Botanic Garden, Edinburgh; it consists chiefly of cryptogamous plants, Grasses, and Cyperaceæ. (J. H. B.* in *Imperial Dictionary of Universal Biography*).

Abies nigra.—The Black Spruce in its native forests usually attains a height of from 50 to 80 feet, and has a trunk small in proportion to its height, the diameter at the base ranging only from 12 to 24 inches.† The branches are drooping, like those of the European species, and are clothed with foliage of a dark sombre green, with a bluish-glaucous hue, unlike any other Conifer. The leaves are short, stiff, thick-set, and cover the stems all round.

* John Hutton Balfour.

† It is covered with a thin greyish bark, slightly roughened with small scales.

As in all the American Spruces, the cones are very small, rarely exceeding 1½ inch in length; when first formed they are blackish-purple, and, till their maturity, are of a deeper duller colour than those of any other Spruce Fir.

Habitat.—North America, from the Alleghany mountains northwards as far as the 65th parallel, and from the Atlantic Ocean westwards to Wisconsin.

Introduced into England about the year 1700 by Bishop Compton.

The Black Spruce holds relatively the same position, in an economic sense, among the Coniferous trees of north-east America, as the Norway Spruce does among those of Europe. Its timber is of excellent quality, light, strong, and elastic; durable when protected, but decaying rapidly when exposed to the weather. It is more used in the British Dominion and the adjoining portions of the United States than that of any other Coniferous tree; it is also exported to Great Britain in large quantities, chiefly to the ports of Liverpool and Glasgow. The consumption of Black Spruce timber is known to be enormous, many thousands of acres being cleared annually to supply the demand.

The Canadian French call the Black Spruce "Epinette à la Bière," because the twigs of the tree used to be boiled in water with other substances such as sugar, molasses, &c., and the liquor being casked and fermented, received the name of Spruce Beer.

The ornamental qualities of *Abies nigra* are not of a very high order, although it possesses some very distinctive characters, but these are only well developed in this country when the trees are growing in retentive loamy soils and moist places, freely exposed on all sides. In the New England States and adjoining provinces of the British Dominion, where the Black Spruce is most abundant, it is found to "delight in cold hilly and mountain regions, attaining its largest size in those moderate elevations, ridges, or slopes, where the soil has a ready drainage, and at the same time retains considerable moisture by reason of its mossy shaded surface and large percentage of dark vegetable mould. It also grows freely in low swampy lands and about sphagnous marshes, but in such localities it is inferior in size and quality."

"The Black Spruce is much disposed to be variable. In open sphagnous marshes, a form occurs so marked in its appearance that in some localities it has received the name of the Bastard Spruce. The branches of this variety are generally slender, the internodes short, and the leaves pale. The tree has a feeble, starved, and sickly aspect, and does not attain a large size. Another form occurs in the Adirondack region; the foliage has a silvery or glaucous hue, on

which account it is sometimes mistaken for the White Spruce. A large form, with cones of unusual size and wood of soft texture, was once described as a distinct species and called *Abies rubra*,* or the Red Spruce, but it is now deemed only a variety of the Black Spruce; its range is northwards. But the most remarkable variety is found on the highest summits of the Adirondacks. It is the variation of the tree into a mere procumbent shrub, so small that it offers but little impediment to him who would walk over it. These bushes are more or less flattened in outline, the branches issuing nearly from the opposite sides of the trunk as in the Ground Hemlock. They grow in dense patches, completely covering the ground, and in numerous instances with their apices all pointing the same way. They have the short internodes and the short pale leaves of the Bastard Spruce.†

The specific name *nigra*, "black," refers to the dark and sombre aspect of the tree, and to the deeper colour of its foliage and cones, compared with *Abies alba*.

Abies orientalis is a smaller tree than the common Spruce; it is rather dense in habit, owing to the numerous branchlets and their ramifications, all of which are clothed with foliage much appressed to them, so that they appear more slender than those of other species. The leaves are close set on all sides of the branchlets, stiff, obtusely pointed, and when mature of a deep glossy green, the brightest in colour of all the Spruces. The cones are small, sub-cylindrical, pointed at the apex, and from 2 to 3 inches in length.

Habitat.—Mount Taurus and the Caucasian Region, where it forms dense forests. It is abundant in the neighbourhood of Trebizond and the south-eastern shores of the Black Sea.

Introduced into Great Britain in 1839.‡

Not much is known of the economical uses of *Abies orientalis*. Its wood is remarkably durable and tough,§ and is doubtless applied to similar purposes as that of the European species.

Abies orientalis is one of the most ornamental of the Firs. Although the habit is of the same pyramidal character as that of the other Spruces, it has its formality much diminished by the projection of

* All the specimens we have seen of this Fir, and they are few in number, are scrubby bushes, with branchlets more numerous and more slender, and with leaves somewhat shorter and more linear than in *Abies nigra*.

† From a Paper on *Abies nigra*, read before the Albany Institute, by C. H. Peck, Esq.

‡ Lawson's *Pinetum Brit. Abies orientalis*, p. 3.

§ Ausgezeichnet dauerhaft und zähe. Henkel und Höckstetter, *Nadelhölzer*, p. 193.

Abies orientalis at Highnam Court. Present height (1881) 53 feet.

many of its slender branchlets, which makes the outline peaked and pointed. The colour of the foliage is not only distinct but also attractive; when the buds first cast off their scaly protection, and burst into growth in spring, they are bright yellow, the tender shoots as they lengthen become a soft delicate green, forming a beautiful contrast to the rich colouring of the mature foliage. *A. orientalis* should have a place in every collection of Conifers; it is quite hardy, but of rather slow growth in dry soils.

The specific name, *orientalis*, "eastern," was given by Tournefort in reference to its habitat.*

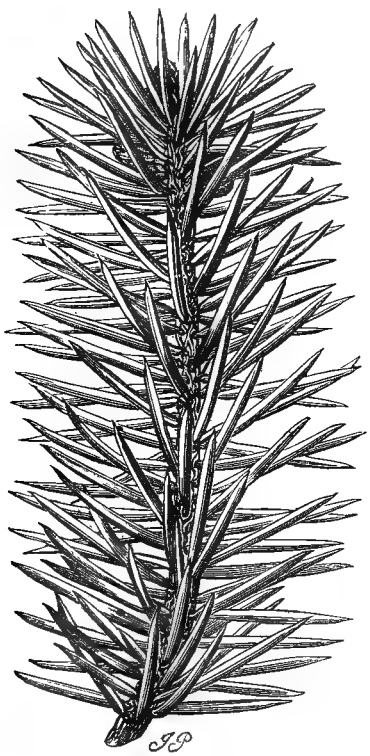


Fig. 9.—Foliage of *Abies polita*.

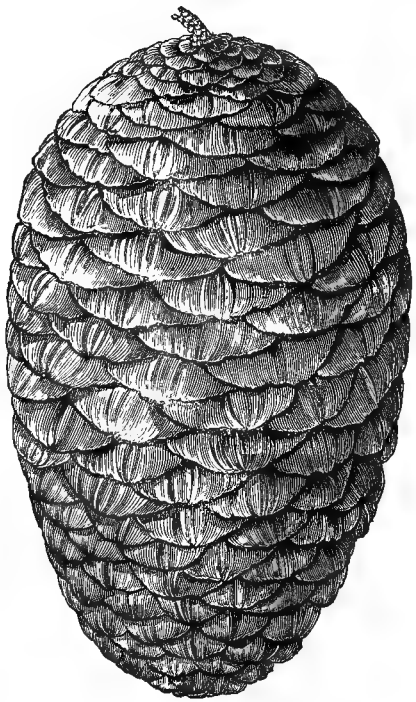


Fig. 10.—Cone of *Abies polita*.

Abies polita, according to Dr. Siebold, is "a remarkable tree entirely of the habit of the common Spruce." As seen in its young state in this country it is one of the most distinct of Firs. Its habit is conical, with the outline much broken by projecting

* The application of the word *orientalis* in this instance is indefinite. By the law of relativity it implies an *occidentalis*, or western, a name that has not been given to any of the Spruce Firs.

branchlets, which are remarkably rigid and robust, and covered with a yellowish cream-coloured bark, on which the decurrent bases of the leaves are prominent. The leaves, which are produced on all sides of the branches and their ramifications rather distant from each other, are spirally arranged around them; they are short, erect, rigid, slightly falcate, and very sharp-pointed, distinctly tetragonal, but compressed, with the faces slightly hollowed. The cones are ellipsoid, from 3 to 4 inches long, with light brown coriaceous scales, minutely notched at the edge.

Habitat.—The mountains in the north of the island of Nippon.* Introduced in 1861 by Mr. J. G. Veitch.

The leading characters of *Abies polita* described above do not adequately convey a just idea of this beautiful Fir, which should have a place in the most select collection of Conifers. It is especially suitable as a specimen tree for the lawn; and, as a picturesque tree for the park, it is one of the most distinct. Its growth is free, its constitution hardy, and it would not be easy to name any Japanese Conifer that has better accommodated itself to the climate of Great Britain than *A. polita*.

In its native country, as the tree becomes old the branchlets and terminal growths become flaccid and pendulous, as in *Abies Smithiana*, to which, by the structure of its cones and other parts, it is nearly allied. The leaves, too, of old trees are a little longer, less robust, and more appressed to the branches than those in the young plants. It has thence acquired the name of "Torano-wo momi," or the Tiger's-tail Fir, among the Japanese.

The specific name, *polita*, "polished," or "adorned," probably has reference to the lustrous smoothness of the foliage, and especially of the scales that protect the buds before they start into growth.

Abies Smithiana, also known among British horticulturists by its synonym, *A. Morinda,*† is a very handsome Fir. Its pyramidal habit is rendered strikingly beautiful by the terminal and lateral branchlets being as pendulous as those of a Weeping Willow. The foliage is dense and light in colour; the leaves are from 1 to 2 inches long, slender in proportion to their length, appressed to the branchlets, and curved inwards. The cones are

* *Pines and Firs of Japan*, by A. Murray, p. 80. Siebold & Zuc., *Flora Jap.*, p. 21.

† From the many Christian and barbarous names by which this Fir is known I select the native one. *Morinda*, in the native dialect, means "Nectar drops," or "Honey tears," from the resinous drops or tears upon the cones and bark resembling honey. It is also named Khutrow, which is, doubtless, a misnomer of the Silma vernacular "Khudrow," or "Noodrow," weeping.—*Senilis in Pinaceæ*, p. 49.

larger than those of any of the Spruce Firs, being 6 inches long and from 2 to 3 inches broad, nearly cylindrical in form, and having broad smooth scales of ligneous texture, thick, with entire edges turned inwards, and of a purplish-brown colour when mature.

Habitat.—The Himalayan Mountains from Bhotan to Cashmere, and throughout the whole of the forests from the Kuram district to Serátigah, in Afghanistan, at elevations ranging from 6,000 to 12,000 feet.

Introduced into Scotland in 1818 by Dr. Govan, of Cupar, who sent cones to the Earl of Hopetown. From the seeds of these cones the first plants, six in number only, were raised.

The economic value of *Abies Smithiana* does not appear to be very great. Sir J. D. Hooker notes that "it has white wood, employed for posts and beams,"* but the timber is soft, and although free from knots, is very perishable.† Dr. Royle states that a very fine resin is secreted in the cones which, no doubt, would yield a superior turpentine. ‡

In England *Abies Smithiana*, when planted in a moist soil, grows almost as rapidly as the common Spruce; in dry soils the growth is slower, and the foliage becomes thin. It is quite hardy, but owing, most probably, to peculiarities in the climate of the Himalayan region, and the high elevation at which this Fir grows—conditions that cannot be secured for it in England—failures are frequent. The plants cannot receive here so long an annual period of rest as they would do on their native mountains, where the winter snows cover them for four or five months of the year; they start into growth in the first mild days of early spring, and the tender shoots are often cut off by frosts later in the season, the effect of which is to weaken permanently, if it does not kill, the plants. A north-west aspect, or one shaded or protected by high trees is recommended for it, provided the soil is loamy and not too dry. The lower branches of some of the largest specimens of *A. Smithiana* in this country have attained lengths of from 12 to 16 feet, so, that in order to secure a good specimen of this noble Fir, a space having a radius greater than these dimensions must be allowed for it.

The specific name, *Smithiana*, was given in compliment to Mr. James Smith, gardener to the Earl of Hopetown, by whom the first plants, above-mentioned, were raised.

The four following are sub-arctic trees, of which the first has not

* *Himalayan Journals*, ii., p. 45. † Gordon, *Pinetum*, p. 21.

‡ *Botany of the Himalayan Mountains*, p. 352.

yet been introduced. The other three do not appear to accommodate themselves readily to the milder climate of Britain; they commence growing early in spring when the weather is mild, and this precocious growth is almost invariably cut off by late frosts. This check gives them a scorched and unsightly appearance, rendering them unsuitable for arboricultural purposes.

Abies Glehnii, as described by Dr. Masters, in the *Gardeners' Chronicle* for March 6, 1880, is a dwarf, dense-growing tree, with small, curved, sharply pointed leaves, crowded in many rows, and oblong ovate cones, variable in size, but generally small, or not much more than 1 inch long. It was found on the island of Saghalien by Schmidt, some years ago, and recently by Maries on the south-east coast of Yesso.

Abies Maximowiczii.—In 1865, seeds of an Abies, native of eastern Asia, were distributed under this name by Dr. Regel, of St. Petersburgh, but of which nothing appears to be known beyond the young plants now growing in many gardens. These are stunted, miserable-looking objects, seemingly unsuited for our climate. They may be recognised by the following characters:—Branches and branchlets quite rigid, the former covered with light cinereous brown, and the latter with light reddish brown bark, much roughened by the decurrent bases of the leaves, and which also are rigid, sharply pointed, not more than half-an-inch long, erect, and dark green, with little or no traces of glaucescence.

Abies obovata resembles *A. excelsa* in its general aspect, but differs from it in some of the details, especially in the cones, which are small nearly egg-shaped bodies, with the greater diameter not more than $2\frac{1}{2}$ inches long. It inhabits Siberia, from the Ural Mountains to Dahurica, and from the Altai Mountains—where it forms vast forests from the base to 4,000 feet of elevation—to the Arctic Regions, as far as lat. 69° 30′ N. In a climate so severe as that of Siberia the economic value of *A. obovata* must be considerable, if used only for fuel. According to Ledebour it is a tall tree, upwards of 100 feet high, and doubtless supplies timber but little inferior to that of the common Spruce.

Abies Schrenkiana is a native of the Altai Mountains and south-west Siberia. It is said to be a tall tree resembling *A. obovata* in its general aspect, but differing from it in having thicker and longer leaves. Like *A. obovata*, of which it is considered by the best authorities* to be only a variety, it does not readily adapt itself to the milder climate of Britain.

* *Prod.*, xvi., p. 415. Carrière, *Traité*, p. 338.

Section II.—Sapini. The Silver Firs.

The Silver Firs are cultivated in Great Britain almost exclusively for ornamental purposes, for which few trees, even among the Coniferæ, are more suitable or more admired. Their general aspect is formal and symmetrical, owing to their strict conical habit and the horizontal direction of their branches, which, with all their appendages, are rigid, more or less robust, and rarely assume the pendulous or sub-pendulous growth common among the Spruce and Hemlock Firs. They are further distinguished:—

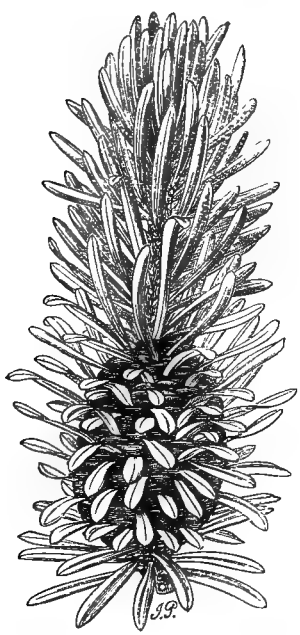


Fig. 11.—Monstrous cone of *Abies Veitchii*, with bracts transformed into foliage leaves, and with the axis prolonged into a branchlet with ordinary leaves. Natural size.

By their leaves, which are linear, or linear lanceolate, flattened, sessile, or with very short twisted foot stalks, grooved above and keeled below, with a silvery glaucous line on each side of the mid-nerve; they are frequently distichous, or sub-distichous, that is to say, two-rowed in direction, and pointing laterally, rarely scattered; also:—

By their cones, which are, in most of the species, more nearly cylindrical in form than those of any other family of the Fir and Pine tribe, and which grow erect on the branchlets; scales much broader than in the Spruces, deciduous, falling off as soon as the seed is ripe, leaving the axis on the tree.*

* In all the Firs the scales of the cones have on their under side, an appendage called a bract, which varies considerably in size and form, being in some species quite minute and even rudimentary, while in others it is conspicuously developed. In the Spruce and Hemlock Firs, the bract is shorter than the scale and is enclosed by it. In the Silver Firs, some species have the bract longer, and others shorter than the scale, while there are others, as *Abies magnifica*, which have the scale and bract of the same length. These bracts are now known to be metamorphosed leaves. Three abnormal or monstrous cones of *A. Veitchii* were recently gathered by Mr. Maries in Japan, in which the bracts were distinctly transformed into more or less perfect foliage leaves. Our illustration shows one of these.

The cones of some of the Silver Firs are among the most remarkable productions of the vegetable kingdom. By the kindness of the Right Hon. Lady Rolle we are enabled to give full size engravings of fertile branchlets of two distinct types, both grown in her ladyship's Pinetum at Bicton, viz., of *Abies nobilis*, native of California and Oregon, and of *A. Webbiana*, which inhabits, at high elevations, the southern slopes of the Himalayas. A conception of the extraordinary beauty of these cones is thus rendered far more clear than could be conveyed by any verbal description.

> In addition to the general characters of the leaves given above, it will be observed that those on the erect shoots are not twisted at the base, and are thicker and convex above. "The tip of the leaves of young trees, and of the lower branches of older ones, is notched in almost all the species; the leaves of robust shoots and of fertile branches are mostly entire, obtuse in some, acute in others. All the leaves have stomata on the under side, arranged in a smaller or larger number of series, forming bands on each side of the keel. On the upper side of the leaf, stomata are present in some and absent in other species." *

The Silver Firs are, with but few exceptions, not only natives of warmer climates, but also in mountainous districts they are found at a lower elevation, and therefore, generally speaking, are less hardy in constitution than the Spruces; and although most of the known species are now thoroughly acclimatised in Great Britain, or in particular parts of it, there are some that have altogether failed thus far to become established in this country. The timber of the Silver Firs is less valuable than that yielded by the Spruces; the grain is coarse and irregular, the wood is brittle and splinters when being worked; it is also very resinous.

The number of species is greater than that of the Spruce Firs, but the habitat of each, with two or three exceptions, is restricted to an area small in comparison with the vast regions over which the principal species of the Spruce are distributed.

> The popular name Silver Fir is referable to the glaucous silvery lines seen on the under side of the leaves of all, or nearly all, the species.

The following Synoptic Table includes all the known Silver Firs:—

* Dr. Engelmann in *Transactions of the Academy of Science*, St. Louis, U.S.A., 1878.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet
ABIES AMÀBILIS (*Lindley*)	*Picea amabilis* (Loudon) *Abies grandis densifolia* (Engelmann)	The Lovely Fir	Oregon	100—150
BALSÀMEA (*Miller*)	*Pinus balsamea* (Linnæus) *Abies balsamifera* (Michaux) *Picea balsamea* (Loudon)	The Balsam Fir	Canada and N. E. States	40— 60
,, Hudsonica (*Engelmann*)	,, *Fraseri Hudsonica* (Gordon) ,, *Hudsonica* (Hort.) ,, *balsamea prostrata* (Hort.)	The Dwarf Balsam Fir	New Hampshire	2— 4
BRACHYPHYLLA (*Maximowicz*)	*Abies Harryana* (Mac Nab) ,, *Tschonoskiana* (Regel) ,, *Veitchii* (Hort) *Pinus brachyphylla* (Parlatore)	The Short-leaved Japanese Fir	Japan	80—120
BRACTEÀTA (*Sir W. Hooker*)	*Pinus bracteata* (Don) ,, *venusta* (Douglas) *Picea bracteata* (Loudon)	The Santa Lucia Fir	South California	120—150
CEPHALÒNICA (*Loudon*)	*Pinus cephalonica* (Endlicher) *Picea cephalonica* (Gordon) *Abies Apollinis* (Link) ,, *panachaica* (Heldreich) *Pinus Abies cephalonica* (Parlatore)	The Cephalonian or Greek Silver Fir	Greece	50— 60
CILÌCICA (*Carrière*)	*Pinus cilicica* (Kotschy) *Picea cilicica* (Gordon)	The Cilician Fir	Mountains of Asia Minor	40— 60
CÒNCOLOR (*Lindley*)	*Abies lasiocarpa* (Hort.) *Pinus concolor* (Parlatore) *Picea concolor* (Gordon) ,, *Lowiana* (Gordon) ,, *Parsonsii* (Hort.) *Abies grandis* (Carrière & Californian Seed Collectors)	...	California and the Rocky Mountains	120—150

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES FÌRMA (*Siebold & Zuccarini*)	*Pinus bifida* (Endlicher) *Picea firma* (Gordon) *Pinus firma* (Parlatore) *Abies bifida* (Siebold) ,, *homolepis* (Siebold) ,, *Momi* (Koch	...	Japan	100—150
FRÀSERI (*Lindley*)	*Pinus Fraseri* (Pursh) *Picea Fraseri* (Loudon)	Fraser's Silver Fir	North Carolina	30— 40
GRÀNDIS (*Lindley*)	*Pinus grandis* (Douglas) *Abies Gordoniana* (Carrière) *Picea grandis* (Loudon)	The Tall Silver Fir	N. California and Oregon	150—200
MAGNÌFICA (*Murray*)	*Abies nobilis robusta* (Carrière) *Picea magnifica* (Gordon) *Abies amabilis* (Californian Seed Collectors) ,, *campylocarpa* (Murray) *Pseudotsuga magnifica* (Bertrand)	The Stately Silver Fir	,, ,,	150—180
MARIÈSII (*Dr. Masters*)	... ...	Mr. Maries' Fir	Japan	100—120
NÒBILIS (*Lindley*)	*Pinus nobilis* (Douglas) *Picea nobilis* (Loudon) *Pseudotsuga nobilis* (Bertrand)	The Noble Fir	N. California and Oregon	200—250
NORDMANNIÀNA (*Spach*)	*Picea Nordmanniana* (Gordon) *Pinus Abies* (Parlatore)	Nordmann's Fir	The Crimea and Caucasus	100—125
NUMÌDICA (*De Lannoy*)	*Picea Numidica* (Gordon) *Pinus Pinsapo* (Parlatore) *Abies Pinsapo Baboriensis* (Cosson)	The Algerian Silver Fir	Kabylia in Algiers	45— 60

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES PECTINÁTA (*De Candolle*)	*Pinus Picea* (Linnæus) ,, *Abies* (Du Roi) *Picea pectinata* (Loudon) *Pinus pectinata* (Lamark)	The Common Silver Fir	Central and Southern Europe	100—125
PÌNDROW (*Spach*)	*Picea Pindrow* (Loudon) *Pinus Pindrow* (Royle)	The Indian Silver Fir	The Eastern Himalayas	75—100
PINSAPO (*Boissier*)	*Pinus Pinsapo* (Endlicher) *Abies hispanica* (De Chambray) *Picea Pinsapo* (Loudon)	The Spanish Silver Fir	Spain	60— 80
,, Hamondii (*Hort.*)	... ...	...	Garden variety	
,, variegata (*Carrière*)	*Picea Pinsapo variegata* (Gordon)	...	,, ,,	
RELIGIÒSA (*Lindley*)	*Pinus religiosa* (Humboldt) *Picea religiosa* (Loudon) *Abies hirtella* (Lindley)	The Mexican Sacred Fir	Mountains of Mexico	100—150
SACHALINÈNSIS (*Schmidt*)	... ...	The Saghalien Fir	Saghalien & Japan	60—100
SIBÌRICA (*Ledebour*)	*Pinus pichta* (Fischer) ,, *sibirica* (Parlatore) *Picea pichta* (Loudon) *Abies pichta* (Forbes) *Picea sibirica* (Hort.)	The Siberian Silver Fir	Siberia	30— 50
SUBALPÌNA (*Engelmann*)	*Abies lasiocarpa* (Hooker) *Pinus amabilis* (Parlatore)	...	Oregon and British Columbia	60—100
VEÌTCHII (*Lindley*)	*Picea Veitchii* (Gordon) *Pinus selenolepis* (Parlatore)	Mr. J. G. Veitch's Fir	...	100—120
WEBBIÀNA (*Lindley*)	*Pinus Webbiana* (Wallich) ,, *spectabilis* (Lambert) *Abies spectabilis* (Spach) ,, *densa* (Griffith) *Picea Webbiana* (Loudon)	Captain Webb's Fir	The Himalayan Mountains	60— 90

Abies amabilis.—The beautiful Fir cultivated in Great Britain under this name, presents the following characteristics. The trunk is covered with smooth cinereous brown bark; the branches are spreading, the lower ones gently inclined downwards, much ramified;

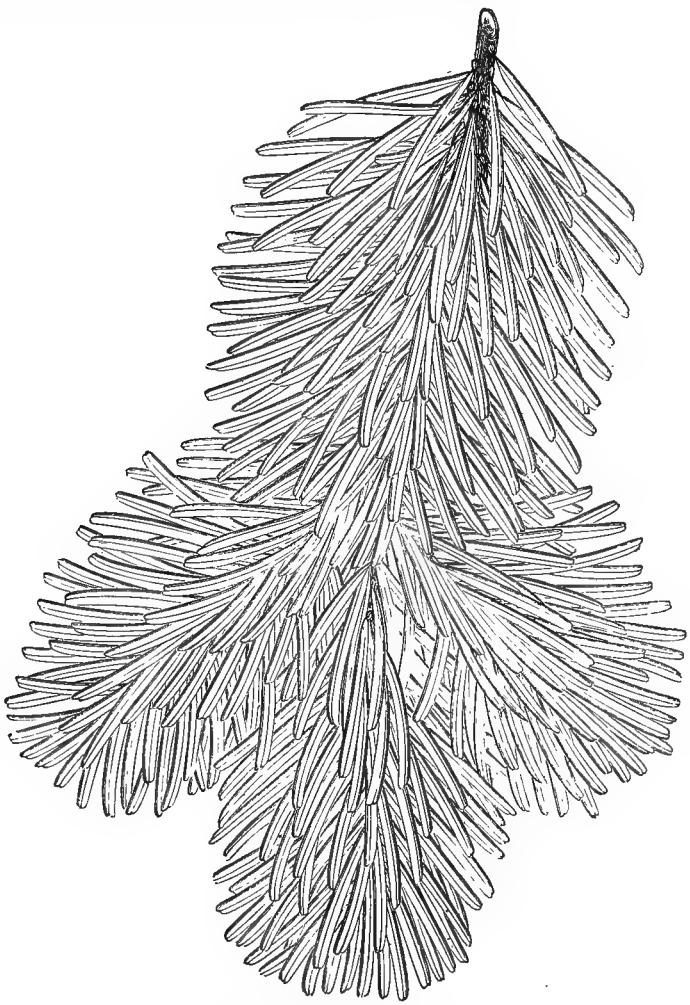


Fig. 12.—Foliage of *Abies amabilis*. Natural size.

the branchlets rather rigid, their bark furrowed with elongated rhomboidal pulvini, and thickly covered with small dark hairs. The foliage is dense and clustered on the upper side of the branches like that of *A. Nordmanniana* and *A. nobilis*. The leaves are longer

than those of *A. nobilis*, straight, glossy green above, with a sunk line along the middle and with two broad glaucous lines beneath. The general aspect of the finest specimens in England (very few in number) is dark and massive, but rendered pleasing and even striking by the feathered decumbent branches and the peculiar deep bluish green of the foliage.

Habitat.—Oregon and British Columbia, from Mount Hood northwards; on the Cascade Mountains as far north as the Fraser river; on Silver Mountain, near Fort Hope, at 4,000 to 5,000 feet elevation.*

Introduced in 1831 by the Horticultural Society of London, through their collector, David Douglas.

Much confusion exists respecting the identity and nomenclature of this and other Silver Firs of north-west America. The synonymy has become especially perplexing in the case of *Abies amabilis*. The tree described above is usually regarded by British horticulturists as the *A. amabilis* of Douglas, who gave no further information about it than the name which he sent home with the cones, none of which appear to have been preserved. In De Candolle's *Prodromus* xvi., p. 426, the tree described as *A. amabilis* is the *A. lasiocarpa* of Sir W. Hooker, (*A. bifolia* of A. Murray), but which Dr. Engelmann calls *A. subalpina*, while the *A. amabilis* of Dr. Newberry, in the Pacific Railway Report, is neither of the preceding, but a variety of *A. subalpina*, which Dr. Engelmann calls *fallax*.† Dr. McNab is of opinion that *A. magnifica* is the true *A. amabilis* of Douglas,‡ and it is the seed of this Fir that is frequently sent to Europe by the Californian seed collectors under the name of *A. amabilis*. To add to the entanglement, *A. concolor*, which Dr. Engelmann affirms is the correct name of the *A. lasiocarpa* of gardens, not of Hooker, for they too are quite different trees, has found its way into European gardens under the name of *A. amabilis*.

It is only till quite recently that the identity of the *Abies amabilis*, described above, with that of Douglas, has been satisfactorily established. In the summer of 1880 Professor Sargent, Director of the Arnold Arboretum at Harvard, U.S.A., accompanied by Dr. Engelmann and Dr. Parry, eminent American botanists, undertook a journey to Oregon and Washington Territory for the purpose of investigating the forests of that region, in the course of which they found *A. amabilis* on the Cascade Mountains, and in other localities. Professor Sargent,

* Dr. Engelmann in the *Gardeners' Chronicle*, 1880, vol. xiv., p. 270.

† *Transactions of the Academy of Science of St. Louis*, 1878.

‡ *Revision of the Species of Abies*, p. 702.

writing to us soon after his return, says of it—"It is a northern tree, not reaching even the northern boundary of California, but not at all rare on the Cascade Mountains of Oregon, and reaching as far north as the Fraser River in British Columbia. It is the most beautiful of the genus with which I am acquainted."

And Dr. Engelmann, in the *Gardeners' Chronicle, loc. cit.*, writes, "On the mountain, just south of the Cascades of the Columbia, where Douglas discovered it, it is a magnificent tree at about 4000 feet altitude; the largest specimen growing on the banks of a mountain torrent was probably 150 feet high, with a trunk about 4 feet in diameter, branching to the ground, and forming a perfect cone of dark green foliage."

The locality of the tree being now accurately known, it is quite reasonable to hope that a supply of seed will soon be forthcoming, and that this beautiful Abies will not much longer be so rare in British gardens.

Abies balsamea is a medium-sized slender tree, from 40 to 60 feet high, but frequently much less, with the diameter of the trunk near the surface of the ground not greater than from 12 to 18 inches. The leaves are distichously arranged, generally in double rows on each side, notched on sterile and pointed on fertile branches, but sometimes variable on the same branch; they are smaller and thinner than those of the common European kind. The cones are from 4 to 5 inches long and about an inch in diameter.

Habitat.—Canada and the north-eastern States, along the Great Lakes as far as the Mississippi; also on the Alleghany Mountains in Virginia and Pennsylvania.

Introduced in 1697 by Bishop Compton.

Abies balsamea Hudsonica is a sterile dwarf variety found in the White Mountains of New Hampshire, above the timber line.*

The specific name *balsamea* refers to the valuable Canada Balsam, prepared from the sap.

Abies brachyphylla.—A Silver Fir of recent introduction, described as a magnificent tree 120 feet high, with a somewhat open aspect, like the *A. pectinata* of Europe, with rather lighter green foliage. It is, however, known to be variable, according

* Dr. Engelmann in *Transactions of the Academy of Science of St. Louis*, 1878.

as it is met with at a high elevation or in the plain, in Saghalien and Jesso in the north, or in Nippon towards the south. The branches are rigid and spreading, and clothed with coriaceous smooth, obtuse leaves. The cones are from 3 to 4 inches long, and purple when mature. The young plants growing in the nursery at Coombe Wood, have the following characters :—Stem erect, branches regularly whorled, horizontal in direction, and covered with light cinereous brown bark, slightly roughened or furrowed by the decurrent bases of the leaves ; branchlets distichous and rigid ; buds covered with pale brown resinous scales ; leaves linear, spirally inserted round the branchlets, but pointing laterally in two directions, owing to a twist above the base, from three-quarters of an inch to 1½ inch in length, those below being the longest, obtusely pointed at the apex or emarginate, bright green above and marked with two silvery lines beneath.

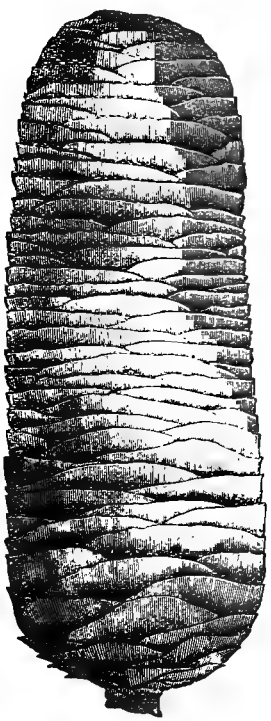


Fig. 13.—Cone of *Abies brachyphylla* (from the *Gardeners' Chronicle*).

Habitat.—Saghalien and Japan.

Introduced about the year 1870.

Abies brachyphylla is one of the hardiest as well as one of the handsomest of Silver Firs, and cannot fail to be a valuable addition to our ornamental trees for the park and landscape. A correspondent in Copenhagen, who sent us a branch for identification, informs us that it stands the Danish winter uninjured, and that the tree in his possession was brought in a young state by the captain of a Danish trading vessel from the island of Saghalien.

The specific name *brachyphylla*, from *βραχὺς* (brachus), short, and *φύλλον* (phullon), a leaf, refers to the shortness of the leaves, but the appropriateness of the name to this species is not very apparent.

Abies bracteata is one of the most remarkable of the Californian Silver Firs ; its strict but stately habit, together with its massive deep green foliage, impart to it a character so distinct, and so impressive, that we cannot incur reproach for giving a somewhat full description of the tree. We do so, however, in the words of

Sir William Hooker,* who has embodied in his remarks an account of the tree sent to Mr. James Veitch by William Lobb, as seen by him on the Santa Lucia, in south California, and by whose exertions it was successfully introduced into England in 1853.

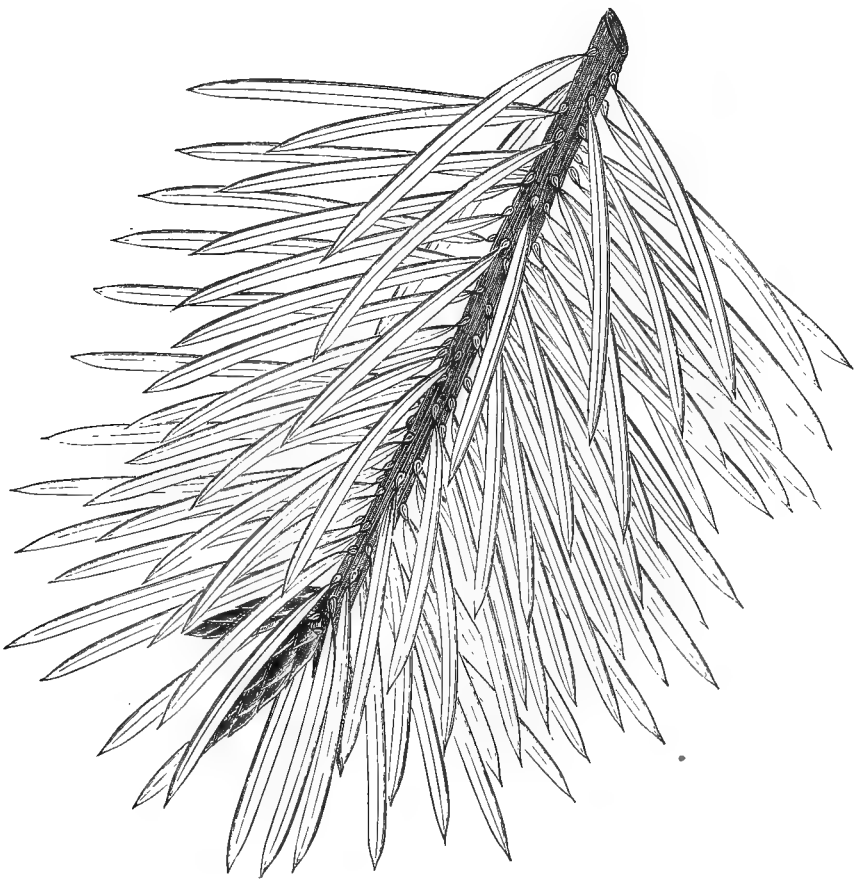


Fig. 14.—Foliage of *Abies bracteata*. Natural size.

"The present subject is among the most remarkable of all the true Pines, particularly in the nature of its cones. Dr. Coulter first discovered it on the Andes of Santa Lucia, a mountain range running parallel with the coast. Douglas met with it at 6,000 feet of elevation in lat. 36° N. These botanists both failed to bring home perfect seeds, and it was left for William Lobb, Messrs. Veitch's indefatigable American collector to succeed in this."

* *Botanical Magazine* for 1853, Tab. 4740.

Abies bracteata at Tortworth Court. Present height (1881) 29 feet.

Mr. Lobb must speak for himself. "This beautiful and singular tree forms here (he writes from the Californian forests) the most conspicuous ornament of the arborescent vegetation. On the western slopes towards the sea, it occupies the deep ravines, and attains the height of 120 to 150 feet, and from 1 to 2 feet in diameter; the trunk is as straight as an arrow, the lower branches decumbent, the branches above are numerous, short, and thickly set, forming a long tapering pyramid or spire, which gives to the tree that peculiar appearance which is not seen in any other kinds of the Pine tribe. When standing far apart, and clear from the surrounding trees, the lower branches frequently reach the ground, and not a portion of the trunk is seen from the base to the top."

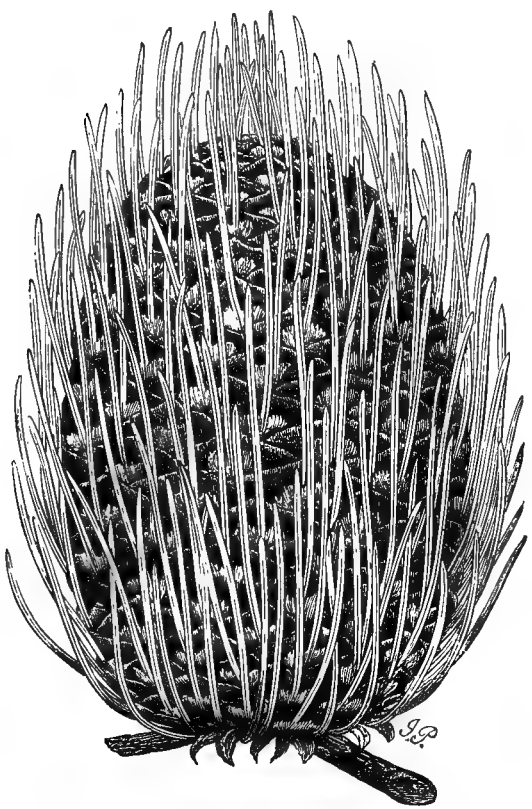


Fig. 15.—Cone of *Abies bracteata*. Natural size.

"Along the summit of the central ridges, and about the highest peaks, in the most exposed and coldest places imaginable, where no other Pine makes its appearance, it stands the severity of the climate without the slightest perceptible injury, growing in slaty rubbish, which to all appearance, is incapable of supporting vegetation. In such situations it becomes stunted and bushy; but even there the foliage maintains the same beautiful dark green colour, and when seen at a distance, it appears more like a handsomely grown Cedar, than a Pine. No doubt it is one of the hardiest trees of the Californian Vegetation, and is equally well adapted for clothing the mountain tops, as the sheltered valley."

"The cones too are quite as singular as the growth of the tree is beautiful. When fully developed, the scales, as well as the long leaf-like bracts, are covered with globules of thin transparent resin, presenting to the eye a curious and striking object. Douglas was mistaken in

saying this Fir does not occur below 6,000 feet of elevation; on the contrary it is found as low as 3,000 feet, where it meets *Taxodium* (*Sequoia*) *sempervirens*."

Sir W. Hooker adds: "Perhaps the introduction of no Conifer, not even that of the Deodar, has excited a more lively interest in horticulture and arboriculture than that of the present species with its porcupine-like fruits."

In less than three months after the publication of the above, in the *Botanical Magazine*, the announcement of the successful introduction of *Wellingtonia gigantea* by Lobb, appeared in the *Gardeners' Chronicle*, with Dr. Lindley's description of the tree; the lively interest alluded to by Sir W. Hooker was thence immensely heightened, and at once transferred to and concentrated on the "Big Tree." *Abies bracteata* receded to the back ground, and has never since been again to the front; its growth in England in its young state is slow, compared with that of the Wellingtonia. The introduction of both trees is still fresh in the memory of hundreds of horticulturists as great events in the annals of their profession, and they can now look upon large trees of Wellingtonia growing in this country; but there are no specimens of the grand Fir from the Santa Lucia that much exceed the height of 25 feet, and they are "few and far between." It is perfectly hardy when planted in exposed and high situations; if planted in low and sheltered spots, it starts into growth early in spring, and the young shoots are frequently cut off by late frosts. It does not appear to acquire the vigour natural to it on its native mountain until it has been established for some years in situations favourable to its growth. Unfortunately, too, seedling plants are still scarce on account of the difficulty in procuring cones. It is, not however, too much to affirm, that while the Wellingtonia is looked upon with a feeling of interest not unmixed with curiosity, *A. bracteata* will always be regarded with genuine admiration.

The specific name *bracteata* refers to the bracts of the cone, which in this species are developed into long rigid leaf-like linear spines, 2 inches long, and slightly curved inwards.

Abies cephalonica is a tree of medium size, not attaining a height of more than 60 feet in its native country. The branches spread out to a great distance so as to form a very broad tree in proportion to its height; the principal branches are produced in regular tiers, but the secondary ones branch from all sides of the primaries. The leaves are very stiff, dagger-shaped, and terminate in a sharp prickle; they are closely distributed over the stems, but both on the lower branches and cone-bearing branchlets they may be found distinctly two-rowed. The cones, which are scarcely dis-

Abies concolor (*lasiocarpa*) at Highnam Court. Present height (1881) 46 feet.

tinguishable from those of *A. pectinata*, are from 5 to 6 inches in length, and about 1½ inch in diameter.

Habitat.—Mount Enos (now Monte Négro) in the island of Cephalonia, whence its specific name. Also, throughout all Greece, on the mountains, from 2,500 to 5,000 feet of elevation, forming dense forests.*

Introduced in 1824 by General Charles James Napier, at that time Governor of Cephalonia.

> Many fine specimens of *Abies cephalonica* are growing in almost every part of Great Britain, proving that it is quite hardy, and that it flourishes in a great variety of soils. It is best planted in a rather exposed situation to prevent starting into growth too early in spring, as the young shoots are frequently injured by late frosts, which prove destructive to so many fine Abies. To secure fine specimens, a space having a radius of not less than from 25 to 30 feet should be allowed for each.

Abies concolor syn. **lasiocarpa,** as seen in its maturity in the Californian valleys, much resembles its great congener *A. grandis*, and, like that noble tree, has a tall straight tapering trunk from 80 to 150 feet high, with a diameter varying from 2 to 4 feet at the base. The habit and foliage of the young trees growing in Britain show, however, that it is quite distinct from *A. grandis*; the branches are more robust—they grow horizontally, and sometimes unevenly, giving the tree an irregular, but by no means an inelegant, outline. The leaves are distichously arranged in double rows, those in the lower row being the longest, or about 2½ inches long, those above of variable length, but generally about one-fourth shorter than those below; they are narrow, blunt, or emarginate at the apex, with a single line along the middle, sunk in the upper surface and raised on the lower one, pale green, and glaucous above, silvery beneath. The cones are cylindrical, obtuse both at base and apex, variable in size, the largest from 4 to 6 inches long, with a diameter of from 2 to 2½ inches, composed of numerous closely imbricated scales, nearly twice as broad as deep, and enclosing a short truncate bract.

Habitat.—The southern Rocky Mountains from Pike's Peak in Colorado westwards to the Shasta in California, at elevations from 3,000 to 7,000 feet. It is also spread over parts of New Mexico,

* Parlatore in *Prod.*, xvi., p. 422.

Arizona, southern Utah, and the valleys and Sierras of California, as far north as Oregon.

Introduced by us in 1851, through our collector, William Lobb; also in the same year by the Oregon Association of Edinburgh, through their collector, John Jeffrey,* both of whom sent it home under the name of *Abies grandis*.

Abies concolor is the most widely distributed of all the North American Silver Firs. Spreading over so extensive an area as that briefly sketched above, and under many conditions of altitude, climate, and soil, it is found to vary considerably in height, in size of trunk, in the colour of its foliage, in the length and form of its leaves, &c., and thus the tree received different names according as it was introduced from different localities. The long-leaved variety from California, to which the above description is more particularly applicable, was first sent to us by Mr. William Lobb under the name of *A. grandis*, but the seedling plants showing a marked difference from the *A. grandis* of Douglas, we distributed them under the name of *A. lasiocarpa*, in deference to the source from which we derived it, and that, too, at a time when scarcely anything was known in this country of the specimens collected by Fendler in New Mexico in 1847. It is now known that the tree in question is not the original *A. lasiocarpa* of Sir William Hooker,† and, therefore, cannot properly retain that name; and the extreme desirableness of freeing the nomenclature of this beautiful tree from the confusion in which it has become involved, will be best effected by adopting the botanical name to which all the varieties are now by the best authorities referred.

The forms known under the names of *lasiocarpa* (Hort. Veitch), with which *Lowiana* (Gordon) is synonymous, and *Parsonsii* (Hort. Barron), were introduced from North California and Oregon. The *concolor* of gardens, as distinguished from these, is from Colorado and in its young state may be recognised by the following characters:—Leaves with both surfaces quite flat, but on the under side the middle nerve may be distinctly traced; they are somewhat shorter and more pointed than in the Californian and Oregon varieties, much closer together, the distichous arrangement much less marked, and they are of a paler green.‡ The cones of the Colorado tree are smaller than those from California. A cone from Pike's Peak, kindly sent to us by our friend and correspondent, Mr. Meehan, of Philadelphia, is less than half the size of the cones from California.

* The *Garden*, vol. i., p. 464. (Mr. McNab).

† See *Revision of the Species of Abies*, by Dr. McNab, in the *Transactions of the Irish Academy*, ii., p. 682; and *Transactions of the Academy of Science of St. Louis*, by Dr. Engelmann, reprinted in the *Gardeners' Chronicle*, 1878, vol. ix., p. 300.

‡ Another variety is cultivated under the name of *Abies concolor violacea*.

That the *concolor* of Colorado cannot be specifically separated from the Californian *Lowiana*, &c., seems to be now conclusively established, but whether the tree is spread continuously through the extensive region assigned to it by Dr. Engelmann, or occurs with greater or less interruptions between the extreme eastern and western limits, does not appear to be clearly made out. When the region has been more completely explored, it is not improbable that other forms may be met with.

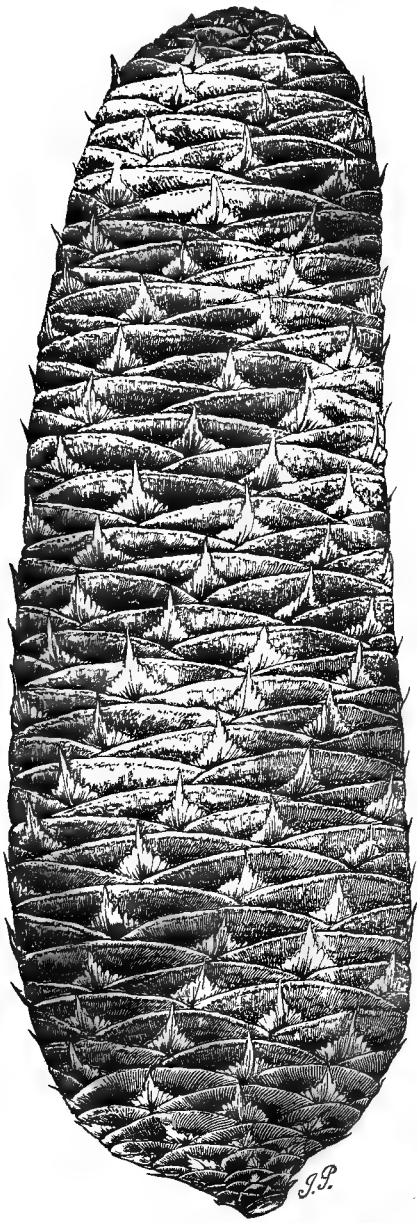


Fig. 16.—Cone of *Abies firma*, from the low-lands of Nippon. Natural size.

Frequent importations of seed from California and other localities have caused *Abies concolor* to be very generally distributed over Great Britain. It is quite hardy and grows well in many soils and aspects. It is a beautiful Conifer for the lawn and park, but to secure well-furnished specimens, a space with a radius greater than 15 feet should be allowed for it, as the lower branches of some of the finest growing in England have attained that length.

The specific name *concolor* "of similar or like colour" refers to the leaves, which in the New Mexican and Colorado varieties are very glaucous, so that both sides are nearly alike in colour.

Abies firma (hitherto distributed under the name of *A. bifida*), is a stately tree of the habit of the common Silver Fir, attaining, in favoured localities in its native country, a height of 150 feet. The branches are horizontal, robust, and covered with light brown bark, slightly furrowed by the decurrent pulvini or cushions, from which the

leaves arise. The leaves are spirally arranged around the branchlets, but point laterally in two directions; they are from half an inch to an inch and a quarter in length, quite rigid, coriaceous in texture, deep glossy green above, paler beneath, with the silvery lines common to the tribe, but faintly traced. They are very variable in form and appearance; on young trees, and on the lower and sterile branches of adult trees they are bifid, the cleft in the larger leaves being so great as to make them appear bi-cuspid; on the upper and fertile branches the cleft is much smaller, and frequently absent, so that the apex is then rounded or obtusely pointed (*see* figs. 17 to 22). The cones too are very variable both in size and shape, generally they are cylindrical or slightly dilated near the base, obtuse at both ends, from 3 to 6 inches long, and well distinguished by their deep brown imbricated scales, bearing protruding keeled bracts, terminating in a sharp point, and with the free edge notched or crenulate.

Habitat.—Japan, throughout the whole extent.

Introduced in 1861 by Mr. J. G. Veitch.

Abies firma is the common Silver Fir of Japan; it is met with everywhere throughout the country, both in a wild state, and in cultivation. Its timber is inferior, and is used chiefly for cases and boxes for the conveyance of merchandise. *A. firma* is perfectly hardy in England; it grows freely when established, and its erect lofty port, and richly coloured foliage, make it a tree of great beauty, both for the lawn and the park.

The specific name *firma* refers to the texture of the leaves (*coriaceo-firmis*, Sieb. et Zuc., *Fl. Jap.*, ii., p. 15).

Abies Fraseri closely resembles *A. balsamea*, from which it may be distinguished by the shorter and more oval cones with largely projecting reflexed bracts. It is a small tree, growing from 30 to 40 feet high, but frequently much less, with branches somewhat more slender, and leaves smaller than those of *A. balsamea*. The leaves are either distichous in double rows, those in the upper rows being shorter than those below, or sometimes scattered; emarginate, or pointed, according as they are on barren or fertile branches, deep green above and silvery beneath.

Habitat.—The highest summits of the Alleghany Mountains in North Carolina.

Introduced in 1811 by Mr. Fraser, a Nurseryman of London, after whom it is named.

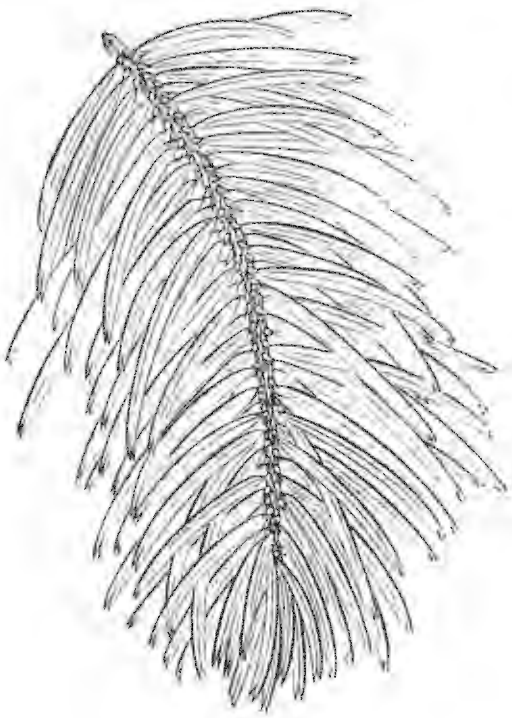


Fig. 17.

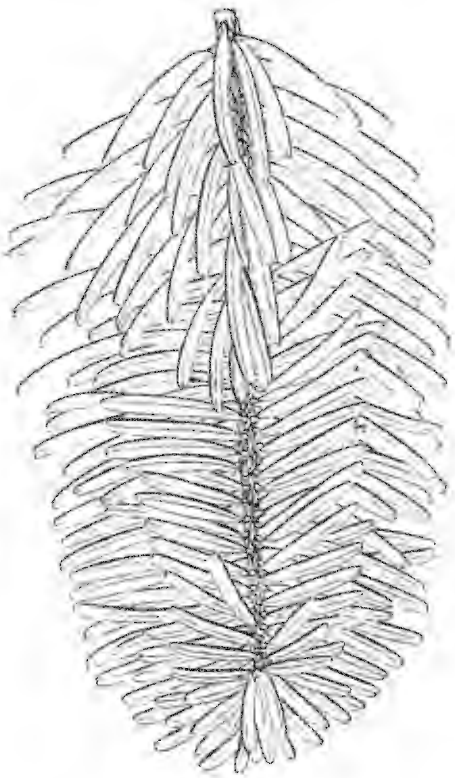


Fig. 18.

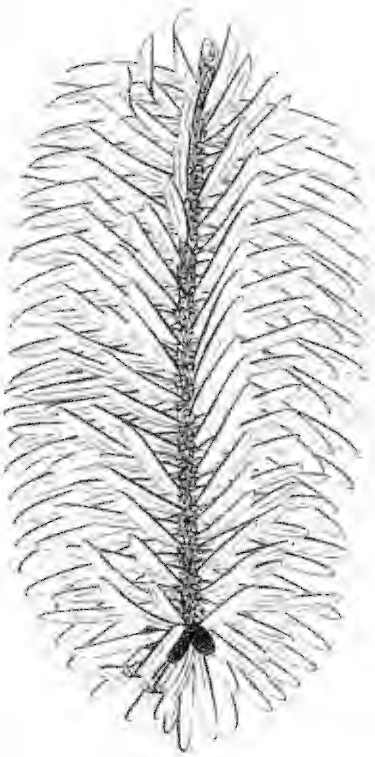


Fig. 19.

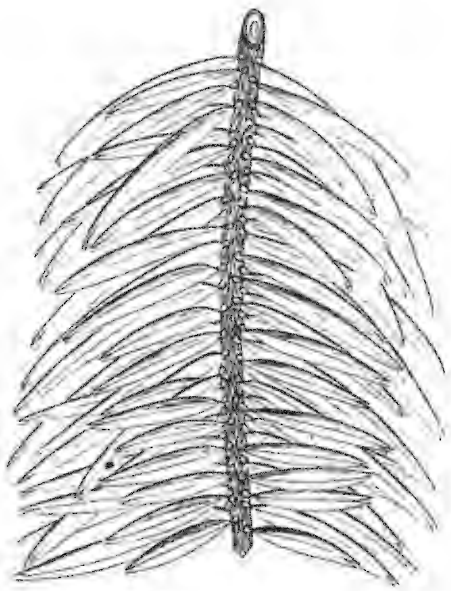


Fig. 20.

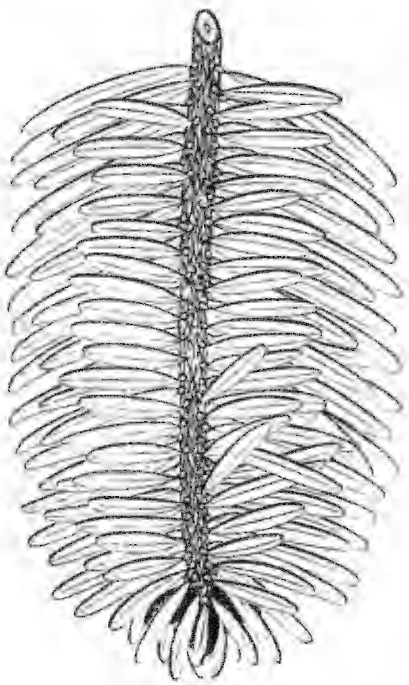


Fig. 21.

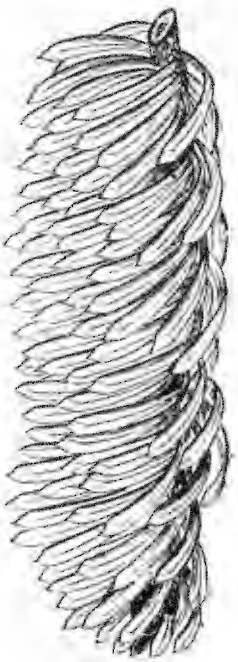


Fig. 22.

Various forms of foliage of *Abies firma*.

Figs. 17, 18, 19 are from the lowlands, and Figs. 20, 21, 22 from the highlands of Nippon. Figs. 17 and 20 are from sterile, and Figs. 19 and 22 from fertile branches. All natural size.

Dr. Engelmann remarks, that "*A. Fraserii* is probably the most local species in the United States, being confined to the tops of the highest mountains of North Carolina, which have an altitude of 6,000 feet, and the tops of which it covers together with *A. nigra*. It is a small tree, probably never more than sixty to seventy-five years old. Forms of *A. balsamea* in the mountains of Pennsylvania, Vermont, and other northern regions, seem to have been mistaken for this species, and are in cultivation in European gardens under the name of *A. Fraserii*."

Abies grandis.—A majestic tree, often towering to a height of 200 feet, and even more, in the rich alluvial valleys of the Columbia

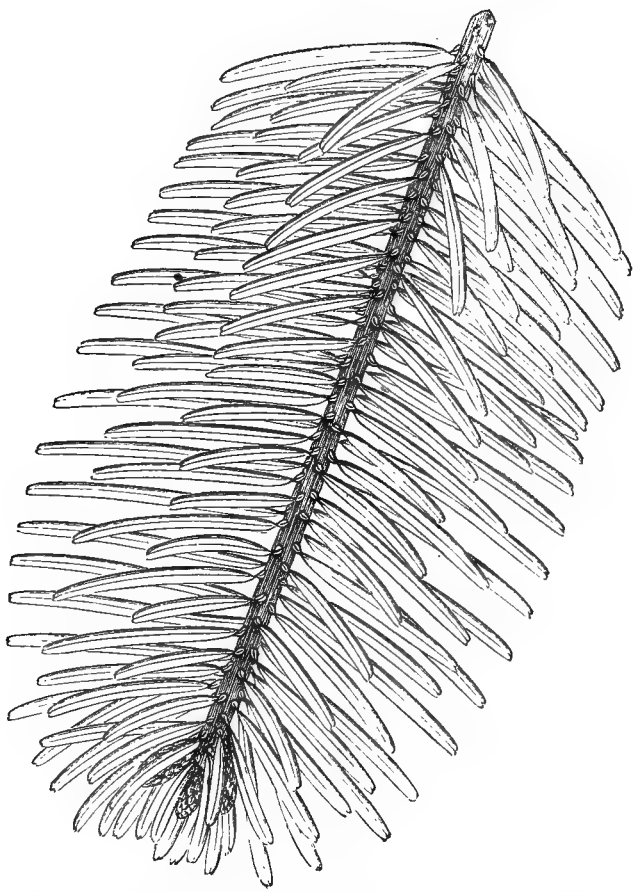


Fig. 23.—Foliage of *Abies grandis* rom a sterile branch. Natural size.

and Fraser Rivers; it is also a graceful tree, the branches being somewhat more slender and less thickly set than in many of the

Silver Firs, and thence the aspect is lighter and more airy. It is rendered very distinct by its foliage, the leaves being "arranged horizontally in double rows on each side of the branchlets in a more or less pectinate manner on short twisted foot-stalks,"* those in the upper row being about one-third shorter than those below, which are from 1 to 1¼ inch long; they are emarginate or blunt, apple green above and silvery beneath. The cones are cylindrical, obtuse at base and apex, 4 to 5 inches long and 2 inches in diameter.

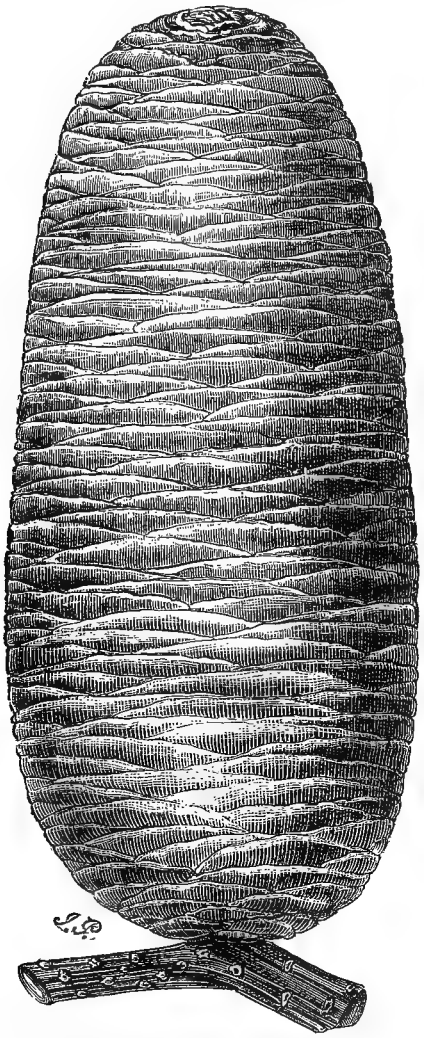


Fig. 24.—Cone of *Abies grandis*, gathered by William Lobb in Oregon in 1852. Natural size.

Habitat.—The littoral region of the north-west coast of North America from Cape Mendocino in California to Vancouver's Island and the Fraser River.

Introduced in 1831 by David Douglas.

Abies grandis takes the first rank in size among the gigantic Firs of north-western America. At McCumbers, and at an elevation of 4,000 feet, it forms a conspicuous element in the magnificent forest composed of this Fir, the Sugar Pine (*Pinus Lambertiana*) and *P. ponderosa*. The measure of several taken in this locality, gives the circumference 21 feet, at 3 feet from the ground, with an estimated height of 150 feet. In open places, the trunk is furnished with branches almost from the ground; they are spreading, and give the

* Gordon, *Pinetum*, p. 217. This description is only applicable to the leaves of specimens growing in Great Britain, of which the branches may be presumed to be sterile. It is most probable that, on fertile branches, they will be found somewhat different, and the formal double-rowed arrangement modified.

tree an extremely elegant feathered appearance, with but little of the formal conical outline common to most of the Silver Firs. In the dense forests of the Lower Columbia, it is much more slender, and the branches are confined to the top. The trunk is straight, smooth, and cylindrical, and furnishes timber of excellent quality. On the Columbia and Willamette, it is known as "White Fir," to distinguish it from "Red Fir" (*Abies Douglasii.*)*

Abies grandis has proved to be perfectly hardy in Great Britain. It is a beautiful and distinct tree, but it is by no means generally distributed over Great Britain, as seedling plants have been till quite recently very scarce. Mr. William Lobb, writing from Oregon to Mr. James Veitch, in October, 1852, says: "The cones of *A. grandis* are very difficult to procure; like most of the tribe, they are produced about the tops, and the trees are so lofty and large that it is almost impossible to climb them. The scales of the cones, too, are deciduous, and by felling the trees the cones fall to pieces, and the seeds are lost."

The specific name *grandis*, "tall," refers to the lofty habit of the tree.

Abies magnifica.—A tall stately tree, attaining a height of upwards of 200 feet, with the diameter of its trunk near the ground from 5 to 8 feet, and often 10, on the Californian Sierras. As seen in England it is one of the most formal of Silver Firs; its straight tapering trunk is furnished at short intervals with whorls of rigid horizontal branches; each branch is feathered with branchlets as stiff as the primary, so that the portions of the trunk between the whorls are fully exposed to view. The foliage is dense, the leaves being more crowded above than below, the longest fully 1¼ inch in length, those above erect and incurved, those below with a distichous expansion; they are olive green, very glaucous on the upper surface when young, the colour becoming deeper and duller by age, and marked with two silvery lines beneath. The cones are cylindrical, 6 to 7 inches long and 2½ to 3 inches in diameter, with the outer edge of the scales incurved.

Habitat.—North California and Oregon.

Introduced in 1851 by the Scotch Oregon Association, through their collector, John Jeffrey.

Abies magnifica is quite hardy, and rarely suffers from late spring frosts, as is the case with many fine Abies that start into

* Dr. Newberry, *Pacific Railway Report.*

growth early in the season. The intervals between the whorls of branches indicate a more moderate annual growth than some of the Californian Abies, but this does not diminish its value as a handsome and distinct ornamental tree for the lawn and park. *A. magnifica* is often confounded with *A. nobilis*, to which, in its young state, it bears a strong resemblance. Mr. Syme, in the *Gardeners' Chronicle* for 1875, p. 753, points out that the two may be easily distinguished by making a transverse section of their leaves, when the leaf of *A. magnifica* will be found to be somewhat tetragonal, and that of *A. nobilis* channelled on the upper side.

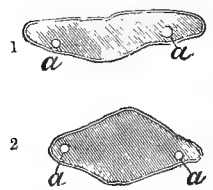


Fig. 25.—Transverse sections of leaves of (1) *Abies nobilis*, and (2) *A. magnifica*, × 12 diameters; *a*, *a*, resin ducts.

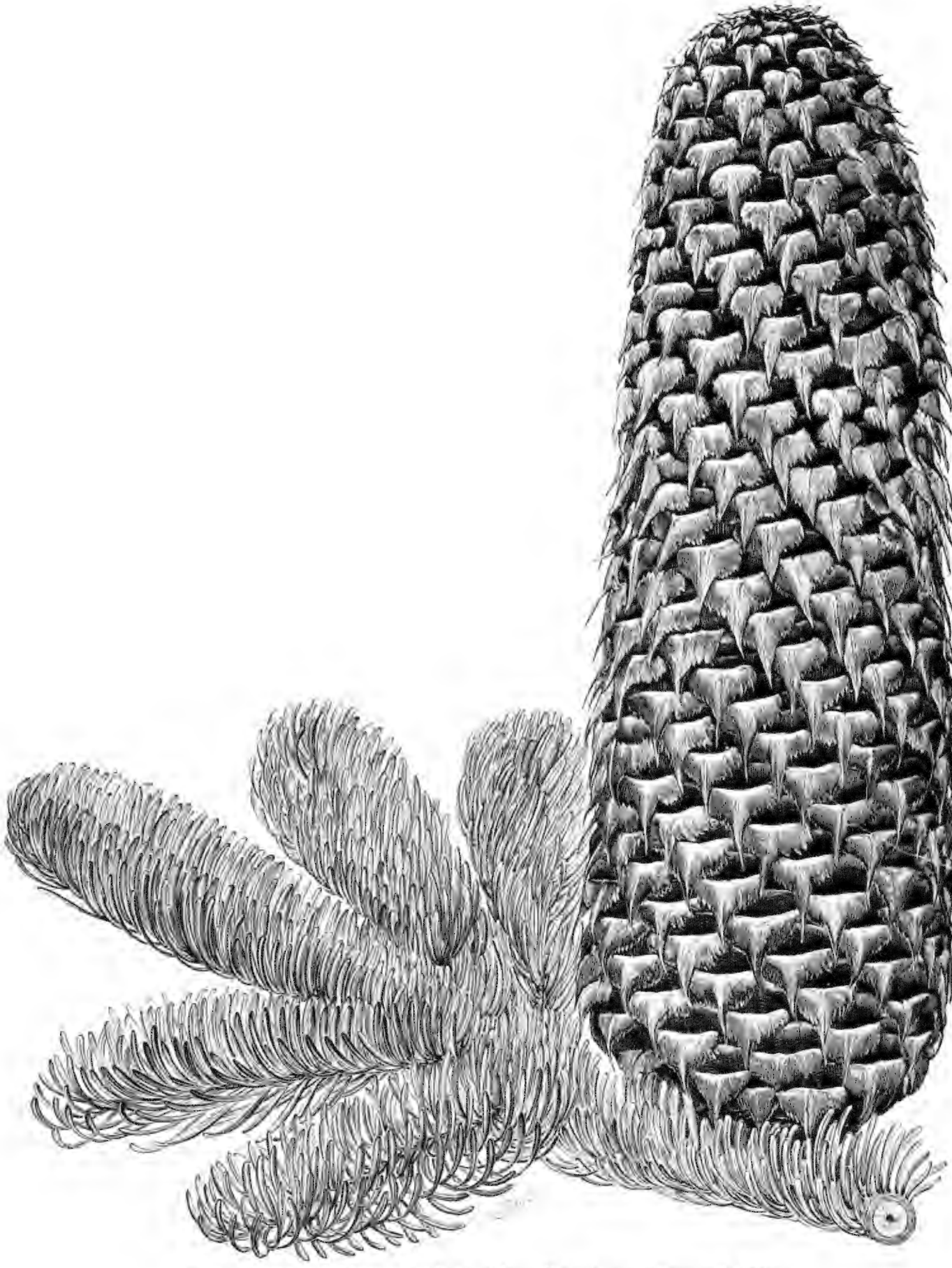
The specific name, *magnifica*, "magnificent," "distinguished," refers to the stately appearance of the mature tree.

Abies Mariesii.—A new Japanese Silver Fir with the following characteristics:—A tall pyramidal tree, with robust spreading branches, the lower ones deflexed and bent upwards at the tips. The older branches are smooth, but marked with the scars of the fallen leaves, the younger ones covered with reddish brown bark. The leaves on the main branches are erect and evenly disposed around the stem; on the lateral shoots they are twisted at the base so as to be in the same horizontal plane; on the younger sterile branches they are pseudo-four-ranked; the lateral leaves spreading; those of the two central ranks on the upper surface appressed and parallel to the long axis of the branch, and not more than half the length of lateral ones; the longer leaves three-quarters of an inch long, and the shortest ones not more than one-third of an inch. The cones are cylindrical, from 3½ to 5½ inches long, narrowed at the base and apex, and from 1½ to 2 inches in diameter, blackish purple when mature, and composed of wedge-shaped scales, sub-orbicular and entire at the free edge.

Habitat.—Japan. At Awomori, and on Mount Nikko, 5,000—7,000 feet elevation in company with *Abies Veitchii*, growing in shallow peat on volcanic debris.

Introduced by us in 1879, through our collector Mr. Maries, after whom it has been named by Dr. Masters (*Gardeners' Chronicle*, vol. 12, p. 788).

This fine Abies will prove an important addition to our park and



Fertile branchlet and cone of *Abies nobilis*. Natural size. Grown at Bicton.

landscape trees, and will probably be found not unworthy of a place among the more select ornamental trees for the lawn. Young imported plants growing in our Nursery, at Coombe Wood, show characters perfectly distinct from every other Fir in cultivation; and the hardiness of the species has been assured by the young plants having withstood the severe winter of 1879—80 uninjured.

Abies nobilis is one of the grandest of the Silver Firs. When standing alone, towering to a height of from 200 to 300 feet, with a trunk perfectly erect, and furnished with branches from bottom to top, it presents an aspect so striking, that its discoverer, David Douglas, who spent three weeks in a forest composed of it, "day by day could not cease to admire it." Its outline is regular without being formal; it is dense with branchlets and foliage without being sombre, and dark without being gloomy. The branches are regularly whorled and spreading, the lower ones decumbent by the weight of their appendages. The foliage is a deep glaucous green, but when young of a delicate pea green, that affords a striking contrast to the deeper colour of the mature leaves. The leaves are very numerous, crowded above, two-rowed below, of different lengths, the longest about an inch and a quarter in length, rigid, curved upwards, obtuse at the apex, with a shallow sunk line along the middle of the upper surface, and with two glaucous bands beneath. The cones, which are remarkably handsome (*See* engraving), are cylindrical, obtuse both at base and apex, about 6 inches long, and from 2 to 2½ inches in diameter; they are well distinguished by the projecting bracts which are bent backwards, and have jagged edges with a rather broad point or tail in the middle.

Habitat.—Principally in the neighbourhood of the Columbia River in Oregon, and southwards as far as the Shasta Mountains in California.

Introduced in 1831 by the Horticultural Society of London, through their collector, David Douglas.

Abies nobilis is universally allowed to be one of the greatest of Douglas' discoveries and introductions. Besides its noble aspect, and the distinct colour of its foliage, it possesses qualities that render it especially valuable in ornamental planting, for which alone it should be employed in Britain, although its timber is useful in its native

country. It is perfectly hardy, and when once established, grows freely in a great variety of soils, and in many aspects. It produces its beautiful cones while in a young state, and seedling plants can be raised without difficulty. The length of the lower branches of the finest specimens at present growing in Britain, range from 15 to 18 feet, so that a space having a radius greater than these dimensions must be allowed for the developement of its grand proportions. The resinous secretions of *A. nobilis* are very abundant. The bark of the trunk is generally swollen with numerous blisters from which a limpid yellowish fragrant turpentine flows freely when an incision is made.

The specific name *nobilis* "noble," is sufficiently explained by the preceding description.

Abies Nordmanniana is a tree of stately habit, and one of the handsomest of Conifers for ornamental planting ever introduced. Although so closely allied to the common Silver Fir, as to be regarded only as a variety, it may be easily distinguished by the following characters:—The branches are horizontal, rigid, and densely clothed with foliage of a beautiful deep glossy green. The leaves, which are about an inch long, are stiff, coriaceous in texture, and are either obtuse or emarginate at the apex, those above pointing upwards and forwards, those below pointing laterally. The cones are slightly ovoid, from 5 to 6 inches long, and from 2¼ to 2¾ inches in diameter.

Habitat.—The mountains of the Crimea and the Caucasus. In the neighbourhood of Aschur, it forms large forests mixed with *Abies orientalis*.*

Introduced in 1848.

Abies Nordmanniana is perfectly hardy, and thrives in a great variety of soils, even in dry sandy places where many other Firs become attenuated and half divested of foliage. It does not commence its annual growth till summer has fairly set in, when it pushes rapidly for about eight weeks, completing its growth in time for the young wood to become ripened before winter. It is rarely injured by the severest frosts in this country.

Abies Nordmanniana sports into many varieties in the seed bed, the departures from the usual type being chiefly in the foliage.

It is named after Professor Nordmann, of Odessa, who first discovered it in the mountains of the Crimea.

* Carrière, *Traité*, p. 277.

Abies nobilis at Highnam Court. Present height (1881) 60 feet.

Abies Numidica.—A medium-sized tree, attaining a height of from 45 to 60 feet, with a trunk about 15 inches in diameter, well furnished with numerous much ramified branches, forming a compact and regular conical pyramid. The branches are spreading or sub-erect, the older ones relatively slender, slightly deflexed, and clothed with shorter leaves. The leaves are from half an inch to 1 inch long, crowded, keeled beneath, marked on each side of the keel by a glaucous furrow and thickened at the margin, obtuse or slightly acuminate at the apex. The cones are erect, often in clusters of four or five, seldom solitary, cylindrical, from 5 to 8 inches long, and 1¾ to 2¼ inches in diameter, and composed of reniform greyish brown scales enclosing a scarious bract.*

Habitat.—Kabylia in Algiers, near the summit, and on the northern aspect of Mount Tababor at an elevation of from 4,000 to 6,000 feet, sparingly interspersed with the Mount Atlas Cedar.

Introduced into France, in 1864, by M. de Lannoy, superintendent of roads and bridges in the province of Constantia; and subsequently received in England.

> *Abies Numidica* is a beautiful tree easily distinguished by the peculiarly bright and pleasing green of its foliage. It stood the severe winter of 1879—80 at our Coombe Wood Nursery without the slightest trace of injury, and its hardiness may therefore be depended on.

Abies pectinata.—The common Silver Fir has a tall tapering trunk furnished with branches, which, with their branchlets and twigs stand out quite horizontally, the entire bough having the flat frondose character common to most of the members of the tribe. In young trees the leaves are distinctly two-rowed, but as they grow older the pectinate arrangement is more or less departed from, especially in the cone-bearing branches. In every stage of growth the leaves are slightly turned upwards, more so on the older trees and cone-bearing branches; they are deep green above, and marked by two silvery lines beneath. The cones are cylindrical, about 6 inches long and 1½ inch in diameter, obtuse at base and apex; before they are quite full grown they are of a reddish colour, which contrasts effectively with the deep green foliage.

Habitat.—Chiefly the mountain districts of central and southern

* Abridged from Carrière, *Traité*, p. 305.

Europe, as far westward as the Pyrenees, and extending eastward to the Transylvanian Alps and the Carpathians. Its northern limit is about lat. 50°, beyond which, it is found only in cultivation.

Introduced into England in the sixteenth century, the precise date not known.*

Many varieties of the common Silver Fir have been from time to time brought under the notice of Horticulturists, some of them showing very remarkable deviations from the usual type. They have been named respectively, *columnaris*, *fastigiata*, *macrophylla*, *nana*, *pendula*, *pyramidalis*, *tortuosa*, &c., names sufficiently indicative of the character of the varieties to which they have been given. These varieties are all, or nearly all of French or German origin; few of them are met with in British Gardens, and these, but rarely.

The Silver Fir forms an important element of the great forests that cover the mountain sides of central and southern Europe, whence it has spread under cultivation into all the neighbouring countries. Its growth during the first few years from the seed is extremely slow, only attaining the height of a few inches in four or five years, but after it has become established, its progress is more rapid. About the twentieth year, and during its full vigour for some years afterwards, the leader will increase from 2 to 3 feet annually.† The height attained by the tree in its maturity varies much according to soil and situation, often reaching from 100 to 150 feet in alluvial valleys, with a trunk of from 5 to 7 feet in diameter. In England the leader is sometimes injured by spring frosts, and the branches bared of foliage by piercing winds, so that when planted for ornamental purposes, it should have a rather sheltered situation.

The timber afforded by *Abies pectinata* is inferior to that of the Spruce Fir; the wood is elastic, but the grain of it irregular; it is soft and porous, shrinks considerably in drying, and soon decays on exposure. In the mountain districts, where it is abundant, it is, however, much used for carpentry of all descriptions, and it is also burnt into charcoal. In some parts of Switzerland the bark is used for tanning. The most important commercial product of the Silver Fir is Strasburg turpentine, so called from its being chiefly collected in the forests of the Vosges, and formerly in the Hochwald, near Strasburg. Substances called colophony and white pitch are also prepared from the secretions of *A. pectinata*. In England the Silver Fir is frequently planted for purposes of utility, no less than for ornament. "No Fir is more useful, either for mixed plantations, groups, beds, or specimen park trees; and for game preserves, thickets, or shelter clumps, few

* It is described by Gerard, in his *Historie of Plants*, 1597, under the name of the Pitch Tree.

† Loudon, *Arb. et Frut.*, p. 2331.

trees are better adapted; for in such situations where a close humid atmosphere, and drip and shade prevail, it is quite at home."*

The specific name, *pectinata*, from *pectinare*, and this again from *pecten*, a comb, refers to the comb-like arrangement of the leaves. *A. pectinata* is the ἐλατή (elaté) of the Greeks; the Abies of Pliny; the Sapin des Vosges, or Sapin de Normandie of the French; the Gemeine Weisstanne and Silbertanne of the Germans; the Abeto bianco and Abeto nostrale of the Italians.

Abies Pinsapo.—A large tree of from 60 to 80 feet high, of pyramidal habit, branched almost from the roots, and clothed with stiff prickly foliage, having more of the "noli me tangere" character than that of any other Silver Fir. The branches are not flat or frondose like those of the common species (*A. pectinata*), but the branchlets are generally whorled, growing from all sides of their primaries, and at right angles to them, forming a dense plexus of twigs that completely hides the trunk from view. The leaves are close set all round the stem, erect, rigid, sharply pointed, and bright green, with very faint silvery lines on the inner side. The cones are cylindrical, from 4½ to 5½ inches long, and with a diameter of little less than half the length.

Habitat.—The mountains in the middle and south of Spain; abundant on the Sierra Nevada at elevations of from 4,000 to 6,000 feet, forming large forests.

Introduced into England in 1839.

Abies Pinsapo Hamondii.—A remarkable deviation from the species. It has a short stem, with the branches excessively developed and quite prostrate, spreading over the ground to a considerable distance. The branchlets and leaves are smaller than in the species.

It is named in compliment to Mr. W. Parker Hamond, of Pampesford Hall, in whose fine collection the original plant is growing.

Abies Pinsapo variegata has the tips of the leaves and portions of the branchlets pale yellow. During the growing season it is very effective.

Abies Pinsapo is quite hardy, and thrives in almost any soil

* *Pinaceæ*, by Senilis, p. 42.

not too wet and cold; it is especially suitable for chalk land where it makes a fine landscape tree, and is the best of the Abies for the lawn. In such situations it should be preferred to *A. cephalonica*, to which it has some resemblance. A space having a radius of not less than 20 feet should be allowed for it.

Pinsapo, the Spanish name of this Fir. The word is compounded of *pino* and *sapino*, which appear to be applied indiscriminately to the Pine and Fir.

Abies sachalinensis.—A tall pyramidal tree with robust branches more or less pointing upwards, and covered with light cinereous brown bark, furrowed by the decurrent bases of the leaves. The

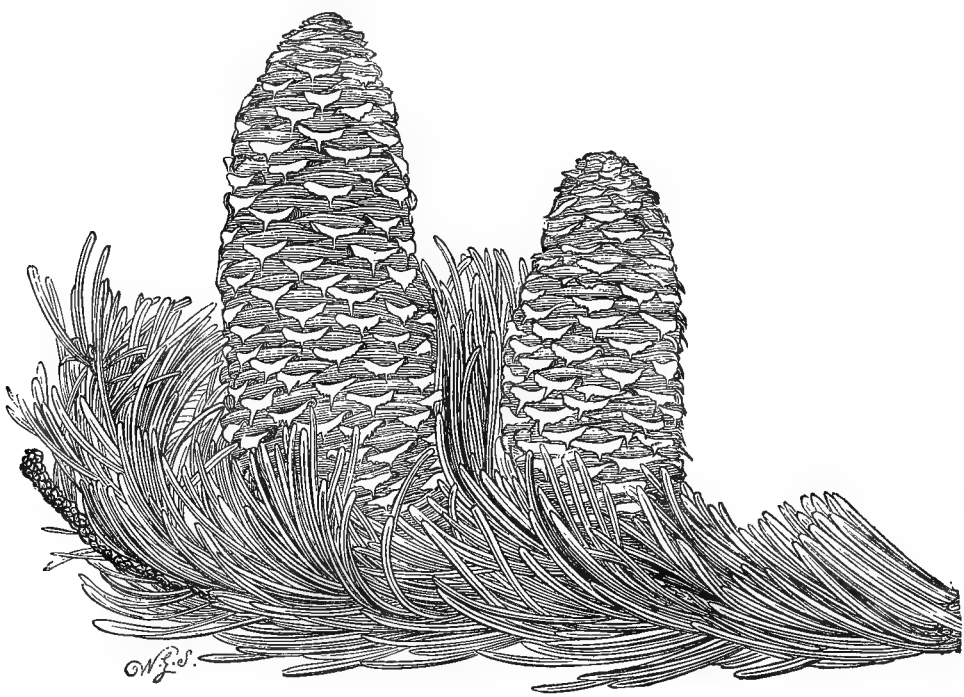


Fig. 26.—Fertile branchlet of *Abies sachalinensis*. Natural size. From the *Gardeners' Chronicle*.

leaves are close set, spirally arranged round the stem; linear, falcate, obtuse at the apex, with a sunk line above, and prominent middle and lateral nerves beneath, from three-quarters of an inch to little more than 1 inch long and about one-twelfth of an inch broad. The cones are sub-cylindrical sessile, either straight or slightly curved, erect, and obtusely rounded at the apex, and composed of

horizontal semi-lunate scales, disposed in a very distinct spiral round the axis, each scale enclosing a membraneous wedge-shaped bract, with a protruding edge turned back over the scale.

Habitat.—Northern Japan and Saghalien.

Introduced by us in 1879, through our collector, Mr. Maries.

Abies sachalinensis is a very handsome Silver Fir with small narrow leaves and small cones, forming, with *A. Veitchii*, a sub-section of the genus. The very distinct and graceful aspect of this tree, together with its hardy constitution, render it one of the most valuable Conifers of recent introduction.

The specific name refers to the island of Sachalin, or Saghalien, where it was discovered by F. Schmidt, a German traveller and botanist, who partially explored the island and the district of the Amour about fifteen years ago.

Abies Veitchii.—A tall, slender, handsome tree, with a trunk upwards of 100 feet high, thickly furnished with whorls of slightly ascending branches. The trunk is covered with whitish bark; that

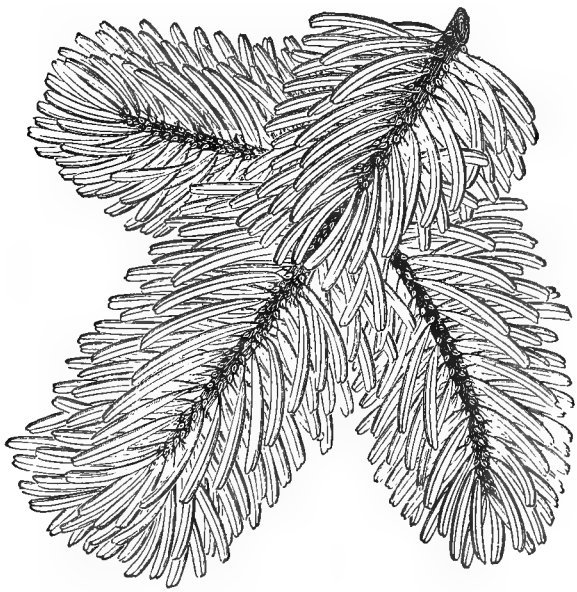


Fig. 27.—Foliage of *Abies Veitchii*. Natural size.

of the branches is also whitish, and slightly furrowed by the pulvini. The leaves are rather close set, the lateral ones spreading in a distichous manner, those on the upper side much shorter, appressed,

and pointing forwards; they are variable in length, from half an inch to 1 inch; emarginate on the sterile branches and obtuse at the apex on the fertile ones; bright glossy green, with a sunk middle line above, and with a prominent mid-rib and lateral nerves beneath, between which are two silvery lines. The cones are sub-cylindrical, erect, purplish-brown, from 2¼ to 2½ inches long, and from three-quarters to seven-eighths of an inch in diameter, composed of horizontal reniform scales so closely packed that the usual spiral arrangement is not easy to trace, each enclosing a short wedge-shaped bract, as long as the scale.

Habitat.—Japan, on Mount Fusi-Yama, at from 6,000 to 7,000 feet elevation; also on Nikko, from 6,000 to 8,000 feet elevation.

Introduced by us in 1879, through our collector, Mr. Maries.

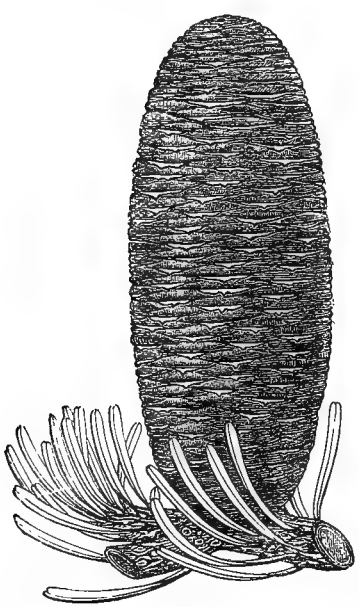
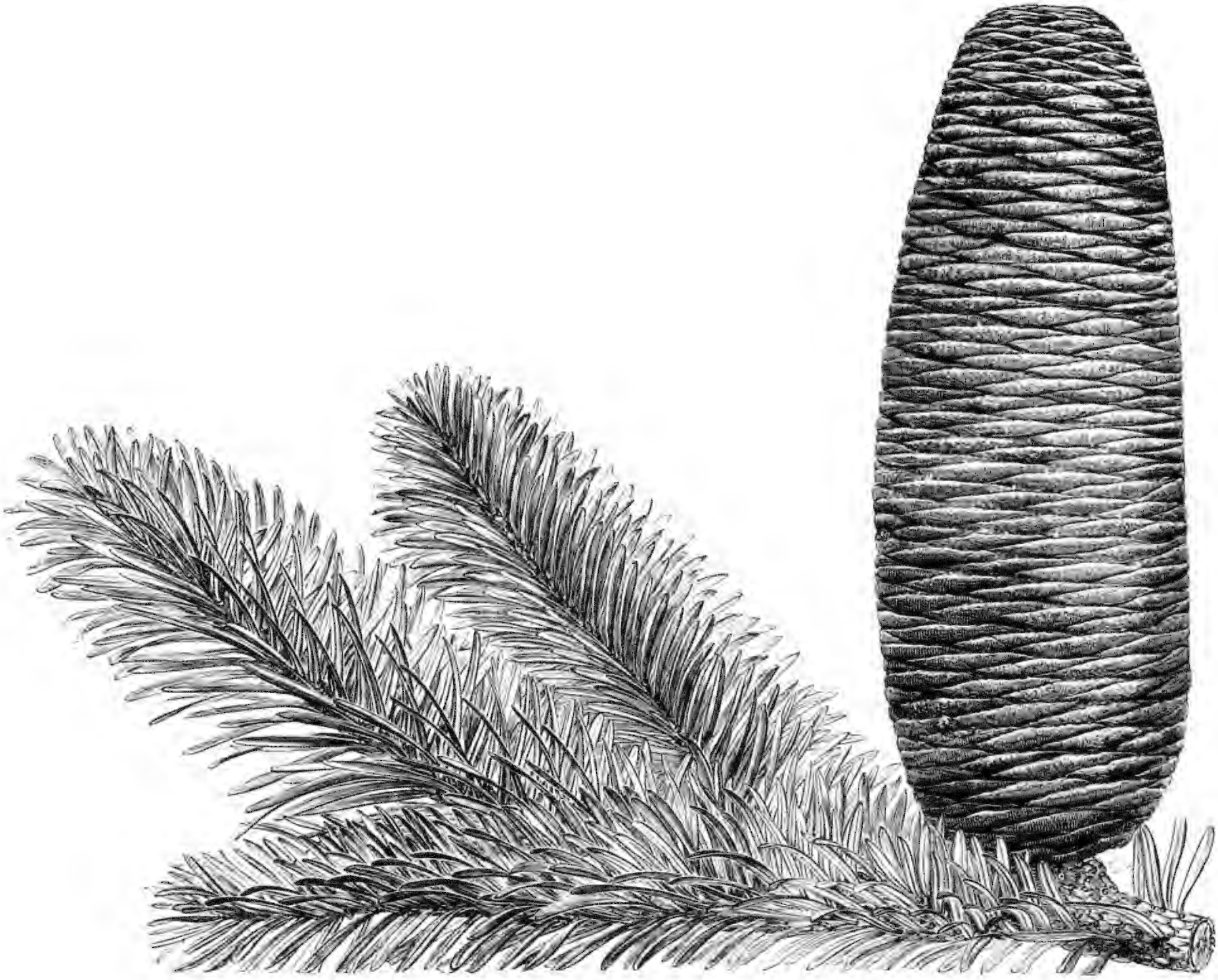


Fig. 28.—Cone of *Abies Veitchii*, from Mount Nikko. Natural size.

This beautiful and interesting tree, which Dr. Lindley characterised as "a most remarkable species," and which he named after Mr. J. G. Veitch, by whom it was discovered in 1860, has long been a desideratum which we have now the satisfaction of supplying, through the energy and perseverance of our collector, Mr. Maries. Although closely allied to *Abies sachalinensis*, described above, so much so that by some botanists the latter is regarded as only a variety—they differ in a horticultural point of view in several important particulars. *A. Veitchii* is essentially an alpine tree, being rarely met with in a wild state below 5,000 feet elevation, attaining its finest proportions on the south and south-western slopes of the central mountains of Japan. *A. sachalinensis* is a lowland tree, growing in the plains of Saghalien, and on the south-east coast of Yesso. It is a larger tree than *A. Veitchii*, having longer branches, so that its pyramidal outline appears much broader at the base; the leaves, too, are longer, and the cones are easily distinguished from those of *A. Veitchii* by the more regularly arranged scales, and by the protruding reflexed bracts.

Young plants of *Abies Veitchii* have withstood the severe winter of 1879-80 uninjured, and the hardiness of the species is thence assured.



Fertile branchlet and cone of *Abies Webbiana*. Natural size. Grown at Bicton.

Fertile branchlet and co

Judging from its preference of situation in its native country, it will prove a suitable tree for elevated spots open to the south or south-east.

The Silver Fir hitherto cultivated in British and Continental gardens under the name of *Abies Veitchii* is quite a different tree from that described above.* We cannot but deeply regret this error in nomenclature on account of the additional confusion thereby introduced into the synonymy of the Japanese Coniferæ. The plants of *A. brachyphylla* distributed by us as *A. Veitchii*, were raised from seed received under the latter name.

Abies Webbiana.—A tree of fine proportions, the outline presented by it during its growth to maturity being broadly pyramidal. The branches are horizontal and robust, the lower ones decumbent by the weight of their appendages. The leaves are linear, bifid, or cleft at the points, coriaceous in texture, and rather rigid; on very young plants distichously arranged in two—four rows; as the tree increases in age and vigour, the foliage becomes much more abundant and very dense; the leaves are then produced in a spiral direction all round the branchlets, but by the twist at the base, they point laterally in two directions in six or eight rows on each side, those in the lower rows being fully 2 inches long, while those above are not more than 1 inch; above they are deep glossy green, beneath they are marked by two broad silvery lines. The cones are cylindrical, composed of closely compressed imbricated scales, from 6 to 7 inches long and about 2½ in diameter, "of an intense purple, full of resin, which exudes in numerous transparent globules, yielding by expression a purple pigment." †

Habitat.—The Himalayan Mountains from Bhotan to Cashmere, at elevations of from 10,000 to 12,000 feet, also in the forests of the Kuram and Hariab districts in Afghanistan.

Introduced in 1822. ‡

Abies Webbiana forms forests of considerable extent on the slopes of the Himalayas at the altitude above-mentioned, where, "notwithstanding the whiteness of the under surface of its leaves, the general effect is exceedingly dark and gloomy." It attains a large size, from 70 to 90

* *See* Dr. Master's paper, on *Abies Veitchii*, *Gardeners' Chronicle*, vol. xiii., p. 275.

† Loudon, *Arb. et Frut.*, p. 2341.

‡ Seeds had been repeatedly sent to England by Dr. Wallich to Mr. Lambert and others, but none appear to have vegetated till the date above given, when some plants were raised in the Fulham Nursery.—Loudon, *Arb. et Frut.*, p. 2341.

feet in height and from 5 to 10 feet, or even more, in diameter. At Tunkra, Sir J. D. Hooker saw trees 35 feet in girth with a trunk unbranched for 40 feet.

The economic value of *Abies Webbiana* to the inhabitants of the Himalayas is considerable—"the wood splits well, is white, soft, and highly prized for durability; it is, however, loose in grain compared with that of its European allies. A beautiful violet dye is extracted from the young cones." *A. Webbiana* is considered tender in many parts of England; it begins to grow early in spring, and this early growth is often cut off by frosts later in the season; but if young plants are protected by a slight covering at the time these frosts occur—and so small an amount of trouble is well worth taking to preserve so beautiful a tree, the injury may be prevented, and as the plants become established by age, they also become more acclimatised. Many fine specimens, growing in various parts of England, attest this; the lower branches of the largest of these have attained lengths of from 15 to 18 feet, so that in selecting a situation for this tree a space having a radius greater than these dimensions should be allowed for it.

The specific name was given by Dr. Wallich in compliment to Captain W. S. Webb, "a distinguished traveller and zealous investigator of Natural History," who first discovered it.

The five following Silver Firs, from causes referred to in the descriptions, cannot be recommended for ornamental planting in Great Britain. It is only under very exceptional circumstances, that any of them have grown into handsome trees in this country.

Abies cilicica.—A tree from 40 to 60 feet high, inhabiting Mount Taurus, in Cilicia, in company with the Cedar of Lebanon, at an elevation of from 4,000 to 5,000 feet. It somewhat resembles *A. Nordmanniana* but its branches and foliage are more slender. The leaves are linear, slightly curved or straight, blunt at the apex, those clustered on the upper side of the branchlets shorter and pointing forwards, those below longer and pointing laterally. It does not readily accommodate itself to the climate of England; it starts into growth early in the season, and it is frequently disfigured by spring frosts.

Abies Pindrow is a noble tree inhabiting the Himalayas of Bhotan, at elevations of from 9,000 to 12,000 feet. It is like *A. Webbiana* in some respects, but may be easily distinguished from that tree by its more tapering habit, longer leaves, which are less glaucous beneath, and smaller cones. It was introduced into England in 1837, by Dr. Royle, but it has generally failed in this country, except in

very favoured spots; it begins to grow early in spring, and its tender shoots are invariably destroyed by frost later in the season.

Abies religiosa is a native of various parts of Mexico, between latitudes 15° and 20° N., but always at a very high elevation, and in some places at the extreme verge of arborescent vegetation. It was named *religiosa* by its discoverer, Humboldt, on account of its extensive use in the decoration of churches on particular occasions. *A. religiosa* resembles *A. bracteata* in its tapering habit and massive foliage, but the leaves are shorter, thinner, and lighter in colour. It was introduced by Hartweg in 1838, but has proved too tender for the climate of Great Britain.

Abies sibirica.—A medium-sized tree, with the habit and general appearance of *A. pectinata*, but "smaller in all its parts." It inhabits Siberia, from the Ural Mountains to Kamtchatka, but is most abundant on the Altai and other ranges of mountains that stretch across the continent from the Caspian Sea to the Sea of Ockhotsk, forming vast forests at elevations of from 2,500 to 5,000 feet. Although it is one of the hardiest of trees, its removal to the more genial climate of Britain has not proved favourable to its developement. Its growth is slow, and it is often disfigured by late spring frosts that destroy the young shoots which have started into growth early in the season.

Abies subalpina, according to Dr. Engelmann, is closely allied to *A. balsamea*, of which it may be considered the western representative. It extends from the higher mountains of Colorado northwards to Oregon and into British Columbia, always scattered, and never alone forming a forest. It is a larger tree than *A. balsamea*, attaining a height of from 60 to 100 feet, with a diameter of 2 feet; the leaves are like those of *A. balsamea*; the timber is poor and soft. Seeds have been introduced under the name of *A. grandis*, and it is probably in cultivation under that name. It has also been recently introduced under Dr. Engelmann's name. Its merits as a decorative tree have yet to be proved.

Section III.—Tsugæ. The Hemlock Firs.

The Hemlock Firs include five or six species cultivated in this country solely for ornamental purposes. They are trees of graceful habit, having slender flexible branchlets, which in some instances are more or less pendulous. They are also further distinguished:—

By their leaves, which are linear, flattened, imperfectly two-

rowed, with very short foot-stalks, obtuse at the apex, and marked with two glaucous lines on the under surface; and—

By their cones, which are pendent, small, not more than an inch or an inch and a half long, composed of coriaceous imbricated scales, with short bracts, and persistent after the fall of the seed.

The economic value of the true Tsugæ or Hemlock Firs does not appear to be very great. The wood of the Japanese species is strong, has a close grain, and is sought after for building purposes; the grain of the Himalayan kind is soft and loose; the timber of the Canadian or common Hemlock Fir is found to decay rapidly when exposed to the atmosphere; it is also coarse grained and poor; but that of the Californian species is said to be fine grained, strong, and durable. The bark of the Canadian Hemlock Fir is valuable for tanning, but it is inferior to that of the Oak; it imparts a reddish tinge to the leather tanned with it.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES Albertiàna (*Murray*)	*Pinus Mertensiana* (Parlatore) *Abies Mertensiana* (Bongard) ,, *Bridgesii* (Kellog) *Tsuga Mertensiana* (Carrière)	Prince Albert's Fir	British Columbia and Oregon	100 to 120
Brunoniàna (*Lindley*)	*Pinus dumosa* (Don.) *Abies dumosa* (Loudon) *Tsuga Brunoniana* (Carrière)	The Indian Hemlock Fir	Nepaul & Sikkim	60—100
canadènsis (*Michaux*)	*Pinus canadensis* (Linnæus) ,, *americana* (Du Roi) *Tsuga canadensis* (Carrière)	The Hemlock Spruce	Canada and adjoining States	45— 60
,, parvifolia (*Hort.*)	*Abies canadensis gracilis* (Waterer)	The small-leaved Hemlock Spruce	Garden variety...	
Hookeriàna	*Tsuga Hookeriana* (Carrière) ,, *Pattoniana* (Engelmann)	...	Mount Baker, Washington Territory	60— 80

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ABIES PATTONIÀNA (*Balfour*)	*Pinus Pattoniana* (Parlatore) *Abies Williamsonii* (Newberry) ,, *Hanburyana* (Hort.) ,, *Hookeriana* (Murray)	Mr. Patton's Fir	California and Oregon	80—150
TSÙGA (*Siebold*)	*Pinus tsuga* (Endlicher) *Tsuga Sieboldi* (Carrière)	The Japanese Hemlock Fir	Japan	25— 30
,, nàna (*Siebold*)	,, ,, *nana* (Carrière)	The dwarf Japanese Hemlock Fir	,, ...	5 — 10
Sub-Section.—PSEUDO-TSUGA.				
ABIES DOUGLÀSII (*Lindley*)	*Pinus Douglasii* (Lambert) ,, *taxifolia* (Lambert) *Pseudo-tsuga Douglasii* (Carrière)	The Douglas Fir	British Columbia Oregon, California	200 to 300
,, pendula (*Hort.*)	... ...	...	Garden variety...	
,, Standishii (*Gordon*)	*Pseudo-tsuga Douglasii fastigiata* (Carrière)	Standish's Douglas Fir	,, ,,	
,, taxifolia (*Loudon*)	*Abies Lindleyana* (Roezl) ,, *Drummondi* (Hort.) *Pseudo-tsuga Douglasii taxifolia* (Carrière)	The Yew-leaved Douglas Fir	South California and Mexico	80—100
FORTÙNEI (*Lindley*)	*Abies Jezoensis* (Lindley) *Pinus Fortunei* (Parlatore) *Ketcleeria Fortunei* (Carrière)	Fortune's Fir ...	South Eastern China	40— 60

Abies Albertiana.—A tall graceful tree, with long flexible branches and pendulous branchlets, clothed with foliage so closely resembling that of the common Hemlock Spruce, as to be scarcely distinguishable from it. *A. Albertiana* may, however, be known by its more

robust and rapid growth, and more spreading branches; also by its redder bark, "the more elongated scales of its cones, and the proportionately longer wings of the seeds." It is perfectly hardy in Great Britain, and it is one of the most ornamental of Coniferous trees for the park and landscape.

Habitat.—North America. The Pacific coast region, from Mendocino to Alaska.

Introduced in 1851 by the Oregon Association of Edinburgh,* through their collector, John Jeffrey, and named in honour of the late lamented Prince Consort, Patron of the Association.

Abies canadensis, the best known of all the Hemlock Firs. It is a beautiful tree of pyramidal habit up to about thirty years of age, after which the top becomes rounded by the gradual lengthen-

Fig. 29.—Fertile branchlet of *Abies canadensis*.

ing of the upper branches and slower growth of the leader; its general habit is then more open and spreading than the other Firs, and the branchlets more slender and pendulous. The cones,

* An association of noblemen and gentlemen, chiefly Scotch, formed in 1850 for the purpose of promoting the Botanical exploration of north-west America, and the introduction into Great Britain of plants and trees, especially Coniferæ, indigenous to that region.

which are smaller than those of any other Fir, have greyish brown broadly wedge-shaped scales, and are produced at the extremities of the branchlets.

Habitat.—North America, eastern portion, from about latitude 35° N., to Hudson's Bay. It is most abundant in Canada (whence the specific name) and the New England States, less common further south, and confined to the Alleghany Mountains at its southern limit.

Introduced into England by Peter Collinson, about the year 1736.

Abies canadensis parvifolia is a very distinct variety, with small pointed leaves not more than half the size of those of the species, scattered over and appressed to the slender branchlets; they are also of a deeper green above, and show but faint traces of glaucous lines beneath.

The common Hemlock Spruce, although one of the hardiest of trees, rarely assumes in this country the elegant form and habit usual to it when standing singly in its native country. Its trunk frequently becomes forked and much divided, and the growth of the branches is irregular, so that it can never be depended on to grow into a symmetrical tree when planted as a single specimen for ornamental purposes. It appears to thrive best in elevated airy situations, and in such places good specimens may occasionally be seen, notably at Norbury Park, near Dorking, the residence of T. D. Grisell, Esq., where are some of the finest trees of *Abies canadensis* in Britain. For landscape and ornamental planting its near ally, *A. Albertiana*, should always be preferred to it.

Abies Hookeriana.—The late Mr. Andrew Murray described this * as an Alpine tree, with a spreading and irregular but remarkably graceful habit, thickly branched and clothed with light feathery foliage. "Leaves slightly curved, with a rib in the middle, and sometimes depressed above so as to give the leaf a triangular or boat-shaped form, rich grassy-green above, pale green and very silvery beneath, except when young and fresh; closely but irregularly set along the young branches, chiefly on the upper side, except at the extremity of the shoot, where they surround the whole twig. Cones ovoido-cylindrical, from 1½ to 2 inches

* Lawson's *Pinetum Britannicum*, part iv.

long, and half an inch in diameter; pendent and dark purple before they are mature, and when ripe pale fawn coloured."

Habitat.—According to the same authority, California, the Cascade Mountains, Scott's Mountain, and the Sierra Nevada, at altitudes of from 4,500 to 6,000 feet.

Introduced in 1854, by Mr. William Murray, and named in compliment to the late Sir William Jackson Hooker.

Abies Pattoniana, as described by Dr. Engelmann,* is "A tall strictly pyramidal tree, 100 to 150 feet high, and 2 to rarely 4 feet through; in high altitudes only a shrub of graceful habit, with slender pubescent branchlets and light green foliage; bark thick,

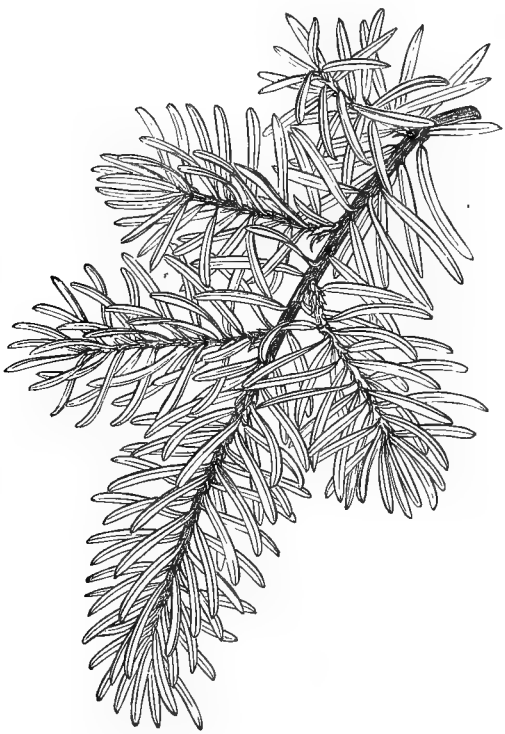


Fig. 30.—Foliage of *Abies Pattoniana.* Natural size.

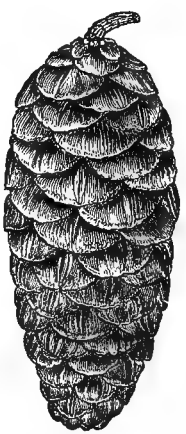


Fig. 31.—Cone of *Abies Pattoniana.*

much cracked and apt to scale off, reddish grey; leaves 6 to 12 lines long (half an inch to 1 inch) angular, acutish, attenuated at base, often curved; cones cylindrical oblong, 2 to 3 inches long."

* *Gardeners' Chronicle*, vol. xii., p. 756.

Habitat.—The higher regions of the Sierra Nevada at 8,000 to 10,000 feet altitude. From Ebbett's Pass northwards through the Cascade Mountains to British Columbia.

Introduced in 1851 by the Oregon Association of Edinburgh, through their collector, John Jeffrey, and named in compliment to Mr. Patton, of the Cairnies, afterwards Lord Justice Clerk, one of the leading members of the association.

By Parlatore and Dr. Egelmann, this and the preceding are both referred to and described as one species, viz., *Pattoniana*. Carrière includes both in his description of *Hookeriana*. Botanically, then, the two trees are considered to be but one species; but as there are two horticulturally distinct forms in cultivation, for which distinguishing names are necessary, we have retained both the names

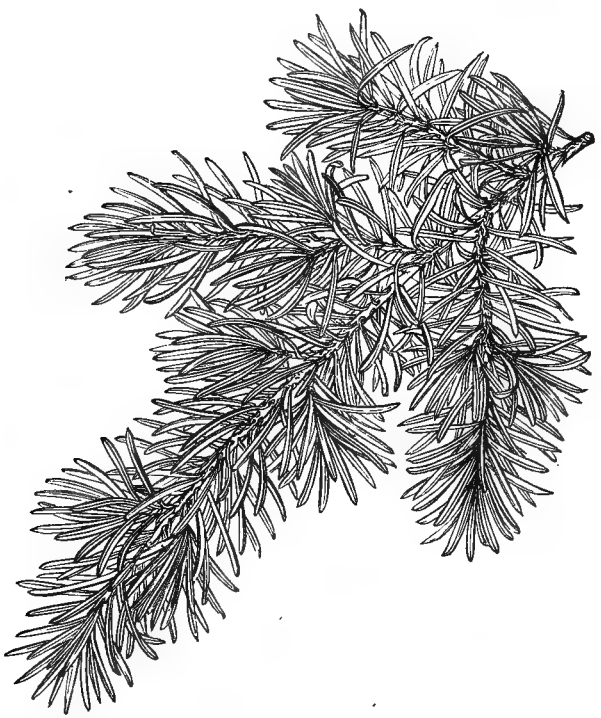


Fig. 32.—Foliage of *Abies Hookeriana* of gardens. Natural size.

in question. There appears to us to be no doubt that Murray's *Abies Hookeriana* must sink to a synonym of *A. Pattoniana*, and that many of the plants in cultivation under the name of *A. Hookeriana* are not the *A. Hookeriana* of Murray, but another form more distinct from

A. Pattoniana than that described by him, and which probably is Jeffrey's first discovery of this Hemlock Fir on Mount Baker, near the British line, in latitude 49° N. The *A. Hookeriana* of gardens has its branchlets shorter and more crowded, and its leaves smaller and more closely set than those of *A. Pattoniana* described above.

Abies tsuga is a small but elegant tree having the habit and general appearance of the Canadian Hemlock Fir, with foliage of a brighter and more cheerful colour. It also differs from it in "the

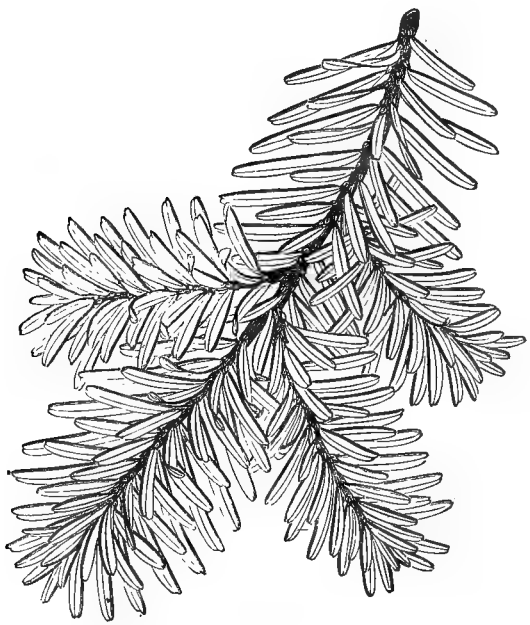


Fig. 33.—Foliage of *Abies tsuga*. Natural size.

Fig. 34.—Cone of *Abies tsuga*.

leaves being emarginate instead of being simply obtuse without emargination, and the scales of the cones orbicular and not wedge-shaped." *

Habitat.—Japan; common in the mountain forests from 3,000 to 6,000 feet of elevation.

Introduced into Europe in 1853 by the late Dr. Siebold.

Abies tsuga nana is a slow-growing variety, with small leaves, and not attaining a greater height than from 4 to 5 feet in Japan, where it originated.

* A. Murray, *Pines and Firs of Japan*, p. 88.

Abies tsuga is quite hardy in England. It is a beautiful tree for small lawns, where the larger Coniferæ would be inappropriate. *Tsuga* is the Japanese name of the tree.

Abies Brunoniana.—The Himalayan Hemlock Fir is "a beautiful species, which forms a stately blunt pyramid, with branches spreading like the Cedar but not stiff, and drooping gracefully on all sides. It is unknown on the outer ranges of Sikkim, but in the interior it occupies a belt about 1,000 feet lower than the Silver Fir, *A. Webbiana*. It here attains a height of 120 feet, with a girth of 20 feet.* *A. Brunoniana* has longer leaves than any of the Hemlock Firs; they are disposed in irregular double lateral rows, those in the lower row being about an inch long, those above one-third shorter, and all very glaucous on the under side. Although found at elevations of 8,000 and 9,000 feet, this beautiful Fir has proved rather tender in this country."

Abies Douglasii "is one of the grandest of the group of giants which combine to form the forests of the West. It attains a height of 200 and even 300 feet, with a diameter of 10 feet at 4 feet above the ground. In its most favoured habitat, about the mouth of the Willamette, it forms forests of which the density can hardly be appreciated without being seen. The trees stand relatively as near each other, and the trunks are as tall and as slender as the canes in a cane brake. In this case the foliage is confined to a tuft at the top of the tree, the trunk forming a cylindrical column as straight as an arrow, and almost without branches for 200 feet."† Such is the Douglas Fir as seen in its native home. In Great Britain some of the older specimens are also rapidly growing into dimensions that will, in a short time, surpass every native tree, and the Douglas Fir may even rival the Wellingtonia in height in this country. As a landscape and park tree *A. Douglasii* is decidedly handsome; its tall straight trunk, when the tree is standing alone, is feathered from the base to the top with branches gradually decreasing in length, and thus producing an elongated pyramidal or spiry outline. The foliage is of a deep but cheerful green; the leaves are about an inch long, two rowed

* Sir J. D. Hooker's *Himalayan Journals*, vol. i., p. 209.

† Dr. Newberry, *Pacific Railway Report*, p. 55. A horizontal section of the trunk of a Douglas Fir 6 feet in diameter was exhibited in the British Columbian Court of the London International Exhibition of 1862. The height of the tree from which it was taken was 309 feet, and its age, according to the rings, 354 years.

on the older branchlets, but on the younger ones they are also produced plentifully along the upper side. The cones are pendulous, from 2 to 3 inches long; the scales thin and leathery, persistent after the fall of the seed, and with narrow, protruding, tricuspidate bracts, the middle process much longer than the two lateral ones.

Fig. 35.—*Abies Douglasii.*

Habitat.—Western North America, as far north as Sitka to the Real del Monte in Mexico, but not continuous through the territory. "It forms the chief ingredient of the vast forests that extend from British Columbia to the Shasta Mountains in California. It is abundant along the coast range from San Francisco to the 35th parallel." It occurs on the Rocky Mountains, with some interruptions, from at least latitude 52° N. to as far south as New Mexico, about latitude 32° N.

Discovered by Archibald Menzies in 1795, and introduced by David Douglas in 1827.

Abies Douglasii pendula is a striking departure from the normal habit, in which the branches droop downwards quite close to the trunk.

The parent plant growing at Woolverston Park, near Ipswich, the seat of John Berners, Esq., is an exceedingly picturesque tree, upwards of 50 feet high; the diameter of the spread of its branches, near the ground, is only 10 feet, or about one-fourth of that of trees of the usual habit of the same height.

Abies Douglasii Standishii.—A remarkable variety, raised from English saved seed gathered from a Douglas Fir growing in close proximity to some large Silver Firs. It has the habit and general aspect of the species, but the leaves are larger, deeper green above and quite silvery beneath, like those of a Silver Fir.

It originated in the Nursery of the late Mr. Standish at Ascot.

Abies Douglasii taxifolia is a variety found in Oregon, and, according to some writers, also on the Real del Monte in Mexico. The branches are stouter than those of *A. Douglasii*, and the leaves longer. It does not attain more than half the height of the species, and the habit of the largest specimens growing in England is more broadly pyramidal, and the general aspect darker and more massive.

Abies Douglasii is one of the most important of Coniferous trees as regards its economic properties, but, owing to the remoteness of the forests in which it abounds, its value cannot yet be said to have been much developed beyond the limits of its habitat. "The timber is heavy, firm, and of as deep a colour as the Yew, with very few knots, and not in the least liable to warp.* It is clean grained, strong, elastic, and acquires large dimensions in unequal climates;† it is very resinous, and forms excellent firewood even when green; in dead trees, the bark and wood are often so full of resin as to burn like a torch, and from its combustability extensive tracts of forest get burnt every year.‡ The amount of timber on one acre in the forest of Douglas Fir near the mouth of the Willamette, very much exceeds that of a similar area in the tropics. Were it not that vegetable tissues will burn readily, the immense mass of it that encumbers the surface of an ordinary farm on the banks of the Columbia, would bid defiance to any efforts that one man could make for its removal during the time of his natural life.§ The British public have had, for some years past, an opportunity of forming an idea of the stupendous dimensions attained by this tree. In the Royal Gardens at Kew is erected a flagstaff of Douglas Fir, brought from Vancouver's Island. It consists of

* Dr. Lindley in *English Cyclopædia*, p. 12.
† *Idem*, in *Gardeners' Chronicle*, 1862, p. 451.
‡ Lawson's *Pinetum Britannicum*, *A. Douglasii*, p. 3.
§ Dr. Newberry, *Pacific Railway Report*, p. 55.

a single piece 159 feet in length, 22 inches in diameter at the base, tapering to 8 inches at the summit; its weight is three tons, and it contains 157 cubic feet of timber. The tree from which this flagstaff was made, was two hundred and fifty years old, as indicated by its concentric rings.*

The Douglas Fir thrives generally in Great Britain, except in the extreme north and in wet marshy places where its roots would get water-logged. Its rate of growth differs considerably in different parts of the country. In Cornwall and Devonshire, the average annual growth is quite 30 inches; in Hampshire and other southern counties it is somewhat less. At an elevation of 600 feet in Perthshire, the observed annual growth of a particular tree was about 18 inches; that of another tree in another part of the same county was found to be 22 inches. In the South of Ireland, the rate of growth equals that in Devonshire, and an instance is recorded of a tree in the county of Meath having made an annual growth of 33 inches. When planted for ornamental purposes, the Douglas Fir should have a clear space with a radius of more than 30 feet assigned to it. In an open place, admitting of a free circulation of air, it is found to retain its lower branches in health and vigour for an almost indefinite period—a circumstance which greatly enhances its value as an ornamental tree.

The specific name was given to commemorate the services of David Douglas, who successfully introduced the tree into Great Britain. It is called the Red Fir by the settlers in British Columbia and Oregon.

Our article on the Douglas Fir would be incomplete without some further notice of him whose name it bears. It has been said that "there is scarcely a spot deserving the name of a garden, either in Europe or in the United States, in which some of the discoveries of David Douglas do not form the chief attraction." The frequent mention of his name in these pages as the discoverer and introducer of some of the finest Conifers that adorn the lawns and parks of Britain, affords abundant evidence that the above quotation contains very much, if not the whole truth, and that to no single individual is modern horticulture more indebted than to David Douglas. His untimely end, the unfortunate circumstances that prevented the publication of his journals, together with the length of time that has elapsed since the introduction to gardens of his finest discoveries, have all tended to dim the memory of his great achievements. The noble Fir that properly bears his name will, it is true, perpetuate it to distant ages; but it is, nevertheless, due to a brave and good man, that something more than the mere name should be kept in remembrance, and therefore, brief and inadequate as it is, the insertion in this place of a sketch of his life needs no apology.

David Douglas was born at Scone, near Perth, in 1799, where his father was a working mason. He received a plain education at

* *Gardeners' Chronicle*, May 11th, 1861.

the parish school, and at an early age showed a strong inclination for gardening, which led to his being apprenticed in the gardens of the Earl of Mansfield, at Scone Palace, for a term of seven years. David was fond of books and the study of plants, and during this period he made himself well acquainted with the native and exotic plants within his reach, and acquired an elementary knowledge of Botany. He greatly improved and extended this knowledge during the two years he served with Sir Robert Preston, of Valleyfield, where he went to live after the completion of his apprenticeship. The garden at Valleyfield was, at that time, celebrated for its choice collection of exotic plants. Douglas was treated with great kindness by Mr. Stewart, the head gardener, who procured for him access to the Botanical Library of Sir Robert. In 1820, he removed to Glasgow, where he was employed in the Botanic Garden of the University. Here he greatly enlarged his knowledge of Botany, and attracted by his intelligence the notice of Dr. (afterwards Sir W. J.) Hooker, at that time Professor of Botany in Glasgow University, and who made him his companion in his botanical excursions to the Highlands and other parts of Scotland for the purpose of collecting materials for his *Flora Scotica*. By Sir William Hooker he was recommended to the Horticultural Society of London, and thus he became known to Mr. Sabine, at that time the able and enlightened Secretary of the Society, through whose influence he was appointed Collector to the Society. His first destination was China, but owing to the unsettled state of the country, that rich field, afterwards partially but successfully explored by Mr. Robert Fortune under more auspicious circumstances, was abandoned for a time, and Douglas was sent to the United States in 1823, whence he made many valuable additions to our hardy fruits, besides procuring several fine plants till then unknown to British Horticulture. In 1824 it was resolved to send him to the Columbia River, on the western side of the Continent, to explore the vegetable productions of the country adjoining, and southwards to California, of which scarcely any thing was at that time known, although a glimpse of the forests of gigantic Coniferæ covering the coast range had been obtained by Archibald Menzies a quarter of a century previous, when accompanying Vancouver on his interesting voyage. An opportunity occurred through the agency of the Hudson's Bay Company, and he landed at Fort Vancouver, on the banks of the Columbia River, for the first time in April, 1825. From that time till his return to England in 1827, he sent home many beautiful plants, with seeds and dried specimens. Among his earliest introductions were *Abies Douglasii*, *Pinus ponderosa*, and *P. Lambertiana*. In the spring of 1827, he went from Fort Vancouver across the Rocky Mountains to Hudson's Bay, where he met Captain (afterwards Sir John) Franklin, Dr. Richardson, and Captain (afterwards Sir George) Back, returning from their second

overland Arctic Expedition. With these travellers he returned to England, bringing with him the results of his researches. He remained in London two years, and sailed again for the Columbia River in 1829. In addition to his mission as a collector for the Horticultural Society, he was employed by the Colonial Office to take observations on magnetic and atmospheric phenomena, the department supplying him with instruments and contributing towards his expenses. He reached the Columbia River in June, 1830, and spent the remainder of the year in exploring the neighbouring country, and made some valuable additions to the Pinetum, the most important being *Abies nobilis* and *A. Menziesii*. The next year he travelled southwards into California, then a comparatively unknown land, where he found a rich harvest of new plants. In 1832 he visited the Sandwich Islands, and returning to the Columbia River in the same year, undertook an expedition to the Fraser River, where he had a very narrow escape of his life, and lost many valuable papers. He finally quitted north-western America in 1833, having previously resigned his appointment as collector to the Horticultural Society, in consequence of a revolution in the affairs of the Society, which led to the resignation of Mr. Sabine, the Secretary, with whom Douglas identified his interests. He sailed for the Sandwich Islands, where he had remained some months, when an accident put an end to his existence. The natives of the Sandwich Islands were in the habit of making pits in which they caught wild cattle. In one of his excursions, Douglas fell accidentally into one of these pits, in which an infuriated animal was already trapped; the animal fell upon him, and he was found, dreadfully mangled, and quite dead, July 12th, 1834.*

Abies Fortunei.—A remarkable species presenting many characters, or rather a combination of characters, that render it unique among Firs. It is a large tree with horizontal branches, which in maturity and age are rigid, and give it the aspect of a Cedar, but in young trees the branches are less formal and the branchlets sub-pendulous, so that the habit is then more like that of an Himalayan Spruce clothed with the foliage of a Silver Fir. The leaves, which are not very closely approximate, are either scattered or spirally arranged round the branchlets, somewhat sabre shaped, about an inch in length, sharply pointed, marked with a single middle vein and bright green above, paler beneath, with two shallow furrows as in the Silver Firs, but not glaucous. The cones are erect as in the Silver Firs, sub-cylindrical, or slightly tapering from the base to the apex, fully 6 inches long, and composed of broad

* Chiefly from Loudon's *Arb. et Frut.*, vol. i, p. 123.

concave scales that are persistent after the fall of the seed, as in the Spruces.

Habitat.—South-eastern China. Abundant on the mountains to the north of Foo-Chow, intermixed with *Pinus sinensis*.

Introduced by the late Mr. Robert Fortune, in 1846.

The interest attached to *Abies Fortunei* is almost purely scientific. In its native country, its aspect is peculiar rather than handsome, and it is only this peculiarity that would make the tree acceptable for British gardens. The few plants raised from the seed sent home by Mr. Fortune have, however, generally failed; the only living one we know of is in our Nursery at Coombe Wood; it is a stunted bush only a few feet high.

II.—LARIX (*Tournefort*) The Larch.

It is not easy to specify generic characters in the Larch, derived from the organs of fructification alone, that shall clearly distinguish it from the Fir; the flowers are almost identical in structure, and the smaller cones differ but little except in shape and in a few other minor particulars, a difference of degree rather than of kind. In all the species, or so-called species, except one, the scales of the cones are persistent after the fall of the seed, as in the Spruce and Hemlock Firs, but in the Chinese Larch they are deciduous, as in the Silver Firs. The cones attain maturity in one season. In their vegetation, however, the Larches possess characters manifestly distinct from the Firs, especially in the leaves, which are "clustered or fasciculated in consequence of the universal non-developement of lateral branches, so that the leaves themselves make their appearance without a perceptible central axis." * Moreover they are deciduous and soft in texture, while in the Firs the leaves are evergreen and stiff. The Larches are northern trees whose area of distribution coincides pretty nearly with that of the Spruce Firs; they are, therefore, all hardy in Great Britain.

The timber afforded by the Larches is of excellent quality. The wood of the common or European species is said to be more durable than that of any of the Fir and Pine tribe, and is in universal request; the wood of the American or Black Larch is not surpassed in strength and durability by that of any Coniferous tree growing in the same region, and is preferred in Canada and the adjoining States for railway sleepers, &c. Excellent charcoal is made from the wood of the European Larch; Venice turpentine is procured from its resinous

* Dr. Lindley, in *English Cyclopædia*, p. 12.

products, and among the Swiss and Tyrolese Alps the bark of young Larches is used in tanning leather.

Larix is the Latin name of the common Larch; the derivation of the word is uncertain, but it is believed to be allied to a Celtic word *lar*, fat, in allusion to its abundant secretions.

Of the seven or eight species of Larch described by Botanists, the European is the only one planted in this country for purposes of utility, and, with the exception of the beautiful Chinese Golden Larch, which should have a place in every collection, it is the only one that can be recommended for the landscape, the park, and other ornamental planting.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
LÀRIX EUROPÆA (*De Candolle*)	*Pinus larix* (Linnæus) *Abies larix* (Lindley)	The European or common Larch	Central Europe & Northern Asia	80–100
GRIFFÌTHII (*Hooker fil.*)	*Abies Griffithiana* (Lindley) *Pinus Griffithiana* (Parlatore)	The Sikkim Larch	The Himalayas	20— 40
KÆMPFERI (*Fortune*)	*Abies Kœmpferi* (Lindley) *Pinus Kœmpferi* (Parlatore) *Pseudo-larix Kœmpferi* (Gordon)	The Chinese Golden Larch	Northern China	80—120
LEPTÒLEPIS (*Gordon*)	*Abies leptolepis* (Siebold) *Larix japonica* (Carrière) *Pinus leptolepis* (Endlicher)	The Japanese Larch	Japan	30— 40
LYÀLLI (*Parlatore*)	*Pinus Lyalli* (Parlatore)	Dr. Lyall's Larch	Oregon, Cascade Mountains	40— 50
MICROCÀRPA (*Forbes*)	*Larix Americana* (Michaux) ,, *pendula* (Salisbury) *Pinus pendula* (Solander) ,, *microcarpa* (Lambert) *Abies microcarpa* (Lindley)	The American or black Larch	N. America, from the Potomac to the Hudson's Bay	50— 70
OCCIDENTÀLIS (*Nuttall*)	*Pinus Nuttalliana* (Parlatore)	The Western Larch	Oregon	100—150

Larix europæa.—The common Larch is well known as a tall slender tree, with horizontal branches and pendulous branchlets clothed with tufts of linear leaves, but which are often scattered on the youngest growth. "In the spring, when the young leaves have just burst into life, the Larch has a peculiar bright yellowish green tint, which is possessed by no other tree of our forests, and for this reason alone it should be planted with other trees, sparingly in the shrubbery, and in groups or singly in the park." *

Habitat.—The Alps and central Europe, chiefly at altitudes of from 3,000 to 5,000 feet, forming dense forests, often intermixed with the Spruce and Silver Firs, and sometimes with the Cembra Pine. Also Siberia, from the Ural Mountains to Kamtchatka.

Introduced into England prior to 1629, in which year it is mentioned by Parkinson in his *Parnasus*.†

Larix davurica and *L. Ledebouri* take the place of the European Larch in northern Asia, of which they are considered by good authorities to be varieties ‡—the characters in which they differ from it being assigned to geographical position only. They are of no value to British arboriculture, but in the dreary inhospitable regions in which they abound, they add to the scanty resources of the inhabitants in various ways—in supplying fuel logs for their huts, &c., and "from the boiled under-bark mixed with rye flour, and afterwards buried for a few hours in the snow, the hardy Siberian hunters prepare a sort of leaven with which they supply the place of common leaven, when the latter is destroyed, as it frequently is, by the intense cold to which hunters are exposed in pursuit of game."

Larix europæa pendula is a weeping variety, originally brought from the Tyrol. The branches, as well as the branchlets, are pendulous. Other varieties have also been met with in cultivation. By far the most remarkable deviation from the usual type with which we are acquainted, is one growing at Henham Hall, Suffolk, the seat of the Earl of Stradbroke. In this variety the branches are excessively developed, apparantly at the expense of the trunk, which is only 11 feet high; they cover a space 100 feet long by 63 feet wide.

The common Larch has been more extensively planted in Great Britain for purposes of utility than any other timber tree. It grows

* Dr. Lindley, in *English Cyclopædia*, p. 12.

† *Idem.*

‡ By Parlatore they are described as distinct species. De Candolle, *Prod.* xvi., 410. Dr. Regel reduces *Larix Ledebouri* to *L. europæa*, but makes *L. davurica*, a species.—*Journal of Botany*, iv., p. 138.

freely on steep hill sides inaccessible to the plough; it may be planted on poor exhausted soil, where other crops would fail or prove unprofitable, with the double advantage of yielding excellent timber itself and fertilising the land by the annual deposit of its leaves. No tree is better adapted for covering used-up gravel pits, brick-yards, and such like places than the Larch, and it should also be mixed with Scotch and Austrian Pines and Spruce Firs when planted for screens and nurses for more tender trees. The rate of growth, according to Loudon, in the climate of London is from 20 to 25 feet in ten years, and it is nearly as much on the declivities of the hills in the Highlands. In the course of fifty years the tree will attain a height of 80 feet; in favourable soils it is said to be fit for every useful purpose in forty years, while the Scotch and Spruce Firs require nearly double that period to form timber fit for building.* The wood is very durable, strong, compact, and easily worked. It is most used for rural purposes generally, as rails, fencing, poles, structures exposed to the weather, &c.; it is also preferred for railway sleepers.

Unfortunately, the Larch is subject to a disease called the Larch rot, which we have already adverted to at page 31. It destroys the heartwood and renders the tree attacked by it worthless. Thousands of valuable trees have been lost through the disease, and whole plantations swept off as by an epidemic. The nature of the Larch rot was investigated some years ago (1859-63), by the Rev. M. J. Berkeley, who published, during that period, the results of his researches in the *Gardeners' Chronicle*, and pointed out some of the causes of the disease, showing that in some circumstances at least, it is quite possible to prevent it. As these papers, or even the substance of them, are too long to be reproduced here, we can only refer the reader, desirous of further information, to them.

Larix Griffithii grows to a height of 60 feet in the deep valleys of the interior Himalayas, but much less on the rocky steeps higher up. It is a tree of very slender habit, sparse foliage, and very long, lithe, cord-like, pendulous branchlets. The erect cones are much larger than those of any other Larch, and further differ from all others in their numerous scales, and in their long reflexed persistent bracts.†

Habitat.—The Himalayas of eastern Nepaul, Sikkim, and Bhotan, at from 8,000 to 12,000 feet of elevation.

Introduced in 1850.

* *Arb. et Frut.*, p. 2354.

† Sir J. D. Hooker, *Illustrations of Himalayan Plants*, xxi.

Named in compliment to William Griffith, a Surgeon and Naturalist in the service of the East India Company, and for some time Professor of Botany in the Medical College at Madras.

Larix Kæmpferi is the most ornamental of all the Larches. It is a moderately vigorous growing tree of pyramidal habit. The branches and branchlets are like those of the common Larch, and the leaves are fasciculated in the same way as in that tree, but they are longer and broader; at first they are of a light yellowish green, with a soft pleasing tint, peculiarly attractive in the spring months; as the season advances they become much deeper and duller in colour, and in the autumn finally change to a bright golden yellow. "The cones are pendulous, about 3 inches long and 2½ inches in diameter, with excessively deciduous scales, diverging like those of an artichoke head, to which, on a small scale, the whole cones bear no little resemblance. The seeds are exactly the size of the scales, two of them occupying the whole inner face with their wings. The least touch suffices to break up the cones, when the scales fall asunder."*

Habitat.—Eastern and northern China.

Introduced in 1846 by Mr. Robert Fortune.

This beautiful tree was first made known to Europeans by Engelbert Kaempfer, a native of Detmold, in Germany (A.D. 1651—1716), the first European naturalist who visited Japan, which he did, in 1690, in the capacity of physician to the Dutch Embassy. He made notes of everything he saw, which he afterwards published in a book called *Amœnitates Exoticæ*, in which the first mention of this tree is made.† Nothing more was seen or heard of it till Mr. Fortune's visit to China, where, he informs us,‡ he frequently met with it in a dwarf form in gardens, but not in a wild state, till February, 1854, when he found some trees near a Buddhist monastery in the western part of the maritime province of Che-kiang, which lies immediately south of Shanghai. These trees are remarkably fine specimens, their stems being fully 5 feet in diameter at 2 feet from the ground, and the estimated height from 120 to 130 feet.

The Chinese Larch is appropriately dedicated to Kæmpfer, in re-

* Dr. Lindley, *Gardeners' Chronicle*, 1854, p. 255.

† In these words, "*Seosi* vulgo *Kara Maatz Nomi*, Larix Conifera nucleis pyramidatis, foliis deciduis." The vagueness of this description has given rise to a doubt whether *Larix Kæmpferi* is the tree referred to, it being almost equally probable that the Japanese species, *L. leptolepis* may have been the tree noticed.

‡ *Gardeners' Chronicle*, 1855, p. 242.

membrance of his early discoveries and valuable contributions to Natural History Science.

Larix leptolepis.—A low or medium-sized tree, closely resembling the European species, to which it is inferior, both as an ornamental and a timber tree. It bears small rounded ovate cones from one-half to three-fourths of an inch in diameter.

Habitat.—Japan, between latitudes 35° and 40° N., especially on the mountains of Nippon.*

Introduced in 1861 by Mr. J. G. Veitch.

The specific name refers to the scales of the cone; it is compounded of λεπτὸς (leptos) thin, and λεπὶς (lepis) a scale.

Larix microcarpa.—A tall slender tree, attaining a height of from 70 to 90 feet in some parts of the region over which it is distributed, but considerably less in England, its trunk having a diameter of not more than from 24 to 30 inches. It has an inelegant, awkward habit, its branches growing in all directions, some at acute angles to the trunk, others horizontal, and others again quite drooping. The foliage is somewhat more sparse, and duller in colour, than that of the European species.

Habitat.—North America, the eastern portion of the continent from the river Potomac northwards to Hudson's Bay, and from Newfoundland westward, to Wisconsin.

Introduced in 1739 by Peter Collinson.

Larix microcarpa is the American or Black Larch; it is called *Tamarac*, or *Hackmatac* in Canada and the United States. It grows in clumps in low lying ground, generally in the vicinity of lakes and swamps.

The specific name refers to its small cones, μικρὸς (mikros) small, and καρπὸς (karpos) fruit.

Larix Lyalli.—A species, is described by Professor Parlatore under this name, but which has not yet been introduced into Europe. It is said to be found on the eastern slopes of the Rocky Mountains, on the Cascade and Galton range at an elevation of from 6,000 to 7,000 feet. It is a remarkable tree on account of the cobweb-like wool that clothes the leaf buds and young shoots, and the long fringe of the scales of the former. It grows from 36 to 45 feet high.*

Larix occidentalis is described by Dr. Newberry as "a small

* De Candolle's *Prodromus*, xvi., p. 412.

slender tree, with short branches and thin foliage, very unlike the Tamarac of the eastern States; the leaves are long and more slender than in any other species. It grows scattered along the banks of streams rising to the height of 150 feet, with a diameter of from 2 to 3 feet. The foliage is light and feathery, and the cones longer than those of *L. microcarpa.*"* It is a native of California and Oregon.

III.—CEDRUS (*Miller*). The CEDAR.

Although the Cedars are among the most majestic trees in Nature, and also among the most distinctly defined as regards their port and aspect, the rank of a separate genus has been denied to them by many eminent Botanists, as will be seen in our next Synoptic Table. When the organs of fructification alone are considered, it is difficult to find in the Cedars any clearly distinctive characters separating them from Abies or Larix; but, as in the case of the latter, they have a vegetation and habit so strikingly peculiar to themselves, that in a horticultural, that is to say, in a practical point of view, their claim to generic rank is fully established.† Besides their noble trunks furnished with wide spreading branches, which in their maturity attain timber-like dimensions, and in which they differ from every other Coniferous tree growing in Britain, except the common Yew; the Cedars possess the following obvious characters:

The leaves, which are evergreen, are sub-quadrangular, or somewhat four-sided and compressed, stiff, sharp-pointed, fasciculated or in bundles, as in the Larches, but in the young growth frequently scattered as in the Spruce Firs.

The cones are erect, very obtuse both at the base and apex, ovate, or spheroidal in form, with the scales broad and truncated, coriaceous in texture, and very closely pressed against each other in an oblique spiral direction. They attain maturity in two and three years.

The geographical distribution of the Cedars is remarkable; they are confined to three separate regions in the great mountain chains that cross the eastern continent between latitude 28° and 35° N.,

* *Pacific Railway Report*, p. 60.

† In Bentham and Hooker's *Genera Plantarum*, vol. III., pars. 1, p. 439, the Cedars are constituted a separate genus.

with but little interruption, from the Atlantic Ocean to the Chinese Sea. The three species, if species they are, occupy positions nearly equidistant, the Cedar of Lebanon being in the middle, with the Himalayan Cedar (*C. Deodara*), and the Mount Atlas Cedar (*C. atlantica*), east and west of it respectively, and separated from it by an interval of from 1,200 to 1,400 miles. Their habitat is thus restricted to a portion of a zone, the limits of which are included within 7° or 8° of latitude. The Cedar of Lebanon and the Deodar have been associated from remote antiquity with sacred objects and the religious worship of the people inhabiting the region where they abound, caused doubtless by the venerable aspect of the aged trees.

If the generic distinction of the Cedars is apparently so manifest, it is by no means easy to frame specific characters by which the three trees from the three distant regions above-named may be clearly distinguished from each other. In the *Natural History Review* for January, 1862, Sir Joseph Hooker, after giving a general description of the three Cedars in their several habitats, observes—"That as species the three Cedars cannot be distinguished, and that they must all have been derived from one common stock. It should be added that, besides the differences in habit, habitat, and colour of foliage, there are no other distinctions whatever between them—of bark, wood, leaves, male cones, anthers, or the structure of these, nor in their mode of germination or duration, the girth they attain, or their hardiness. Also that all are very variable in habit; so much so indeed is this the case with the Deodar, which is the most distinct of all in habit, that there are several distinct varieties sold by nurserymen, some as stiff leaved, others as dark coloured, and others as short leaved as the Lebanon Cedar. Also, that though the differences in the shape of the seeds and scales of *Libani* and *Deodara* are very marked, they vary much; many forms of each overlap; and further transition between the most dissimilar may be established by intercalation of seeds and scales from *Cedrus atlantica*." Nevertheless, they may be regarded as three well-marked forms which are usually very distinct, and of which each has its own separate importance in the practical operations of planting.

Cedrus, from κέδρος (kedros), the Cedar, but often applied by the Greeks to trees belonging to the Juniper family, probably *Juniperus phœnicea* and *J. excelsa*, just as Cedar is often applied at the present time to the Virginian Juniper (Red Cedar), to *Cupressus thyoides* (White Cedar), and by the Canadians to the common Arbor Vitæ (*Thuia occidentalis*).

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
CÈDRUS ATLÀNTICA (*Manetti*)	*Cedrus africana* (Gordon) *Abies atlantica* (Lindley) *Pinus atlantica* (Endlicher) ,, *Cedrus atlantica* (Parlatore)	The Mount Atlas or African Cedar	The Atlas Mountains, Algeria	80 to 100
DEODÀRA (*Loudon*)	,, *Deodara* (Roxburgh) *Abies Deodara* (Lindley) *Cedrus indica* (De Chambray)	The Indian Cedar The Deodar	The Western Himalayas	150—200
,, argentea (*Hort.*)	... ...	...	Garden variety	
,, crassifolia (*Hort.*)	... ...	...	,, ,,	
,, robusta (*Hort.*)	*Cedrus Deodara gigantea* (Knight)	...	,, ,,	
,, viridis (Hort.)	,, ,, tenuifolia (Knight)	...	,, ,,	
LIBÀNI (*Barrelière*)	*Larix orientalis* (Tournefort) *Pinus Cedrus* (Linnæus) *Larix Cedrus* (Miller) *Abies Cedrus* (Lindley)	The Cedar of Lebanon	Lebanon and Taurus in Syria	60— 80
,, argentea (*Loudon*)	*Cedrus Libani glauca* (Parlatore)	...	,, ,,	

Cedrus atlantica.—A large tree of broadly pyramidal habit, scarcely distinguishable in its maturity from the Cedar of Lebanon, except that the branches are shorter and less tabuliform; the leaves also are shorter, thicker, and more prickly. "The African Cedar further differs from that of Lebanon in having a perfectly erect rigid leader and straight stiff ends to the branches, all which in the Lebanon plant droop more or less. There are two forms of Cedar in Algeria as in Taurus, and characterised by the same differences in each country, viz., a green long-leaved, and a more silvery shorter-leaved variety. Nevertheless, it is generally easy to distinguish the Atlas

Cedar from the Lebanon one, and in beds of young plants the differences are very marked."*

Habitat.—Mount Atlas in northern Africa, at an elevation of from 5,200 to 7,200 feet, forming the prevalent arborescent vegetation throughout the province of Constantine on the eastern Atlas range.

Introduced into Europe in 1841, and subsequently into England.

The African or Mount Atlas Cedar was first mentioned by Guiseppe Manetti, an Italian botanist, in a Catalogue of Plants in the Botanic Garden at Monza, near Milan, published in 1841; the precise date of its introduction is not known. Its growth in England is rather more rapid than that of either *Cedrus deodara* or *C. Libani*. It is quite hardy.

The specific name, *Atlantica*, refers to its habitat (Mount Atlas).

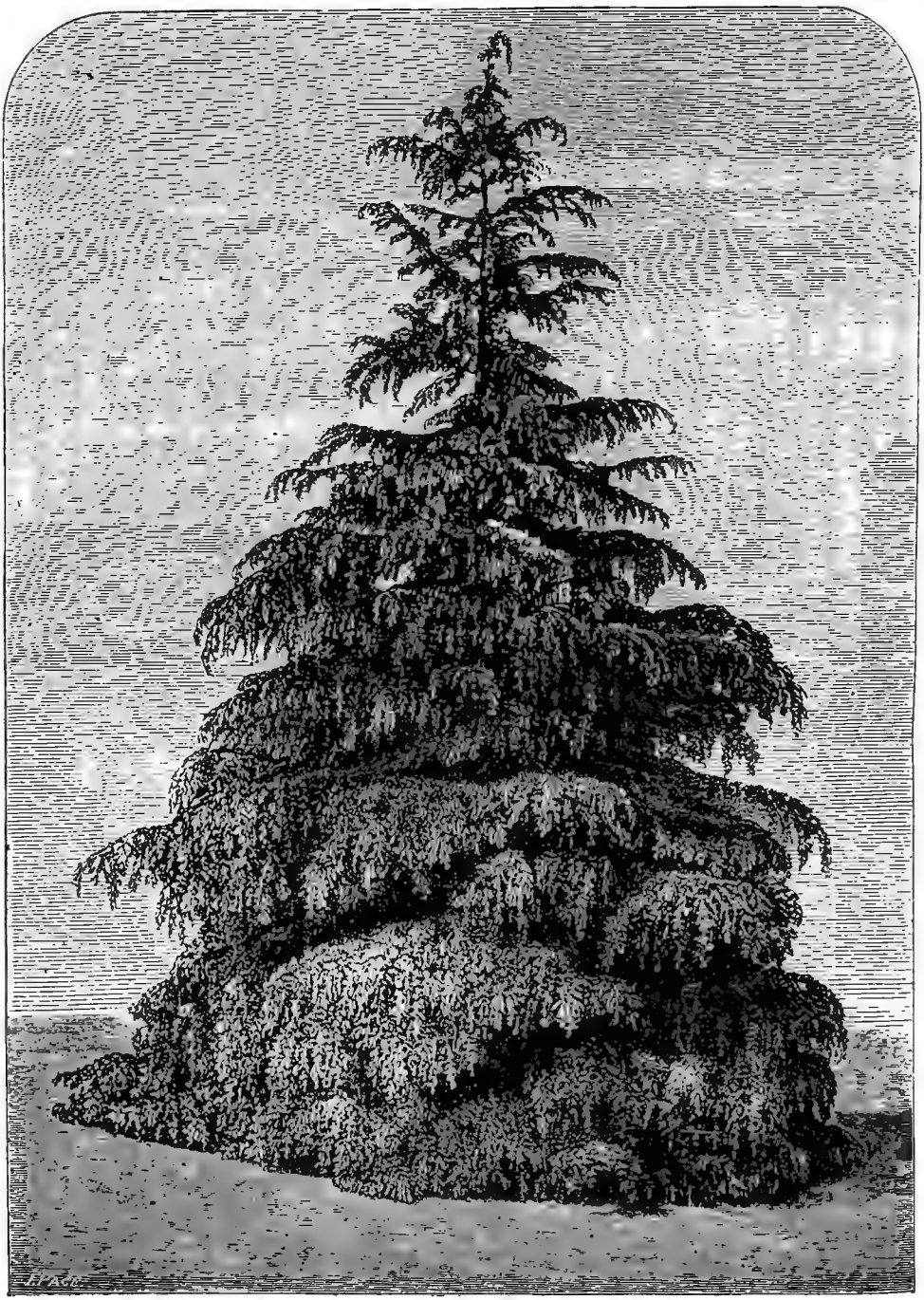
Cedrus Deodara.—The Deodar in its native forests on the slopes of the Himalayas, is an immense tree, often seen from 150 to 200 feet high, with a trunk from 25 to 30 feet in girth. No adequate idea of the grandeur of an old Deodar can be formed from the young specimens growing in Britain, as the trees vary much in appearance during growth. In its maturity, "the branches of the Deodar spread out in horizontal expansions, rising flight above flight in successive steps into a rounded or slightly flattened top. The slightest trace of decay is seldom or never seen in the trunk, and the tree, except when growing in very exposed situations, never puts on the depressed tabulated character of the Cedar of Lebanon."† In this country, in its most familiar aspect, the Deodar is a beautiful tree, with an elongated pyramidal or conical outline broken here and there by projecting branches, with a pendulous leader and drooping branchlets, and clothed with a profusion of light glaucous foliage, which becomes a deep grass green by age. Many of the older Deodars in Britain are gradually growing out of their youthful habit and yearly assuming, more and more, the Cedar character as seen in the native forests, and into the stately majestic forms of which they will, doubtless, ultimately develope.

Habitat.—The Himalayan Mountains, in a continuous forest from

* Sir J. D. Hooker in *Natural History Review*, January, 1862.

† Lawson's *Pinetum Britannicum, Cedrus Deodara*, p. 3. But in the Kuram district in Afghanistan, Dr. Aitcheson remarks, that "It is curious to note that trees here all, more or less, run to trunk, the branches scarcely afford timber at all; and this is especially remarkable on the Hazardaracht River, where the branches are extremely short and very small in calibre."

Cedrus Deodara at Dropmore, Bucks. Present height (1881) 64 feet.



Cedrus deodara at Tortworth Court, Gloucestershire. Present height (1881) 41 feet.

Afghanistan to Nepaul, from longitude 68° to 85° E., at various elevations between 6,000 and 12,000 feet.

Introduced into Great Britain, 1831, by the Hon. W. Leslie Melville.

Varieties.—Since its introduction, some varieties of the Deodar have originated in British Nurseries, which have been named respectively:—*argentea,* in which the glaucescence of the foliage is heightened to almost silvery whiteness; *crassifolia,* the leaves stouter and shorter; *robusta,* the branches and their appendages larger and stouter; *viridis,* the foliage of a deeper green than in the ordinary type.

The introduction of the Deodar marks an epoch in the annals of British arboriculture. Its graceful and beautiful form in its young state, and its grand and imposing aspect in its maturity, place it in the highest rank as an ornamental tree, its value as such being greatly enhanced by the readiness with which it accommodates itself to almost all situations. No position and no variety of soil appears to come amiss to it; on lime or sandstone, rock or clay, it grows with equal facility,"* but in very dry shallow sandy land it becomes stunted and half divested of foliage, in retentive clays it grows into a dense compact tree. The habit, as regards the spread of branches, varies considerably; some specimens spread out their branches horizontally, like the Lebanon Cedar, while in others they are comparatively short and more or less decumbent. To secure fine lawn and park specimens the space to be allowed for the free growth of their lower branches may be regulated by the progress of the tree. The lower branches of some of the oldest Deodars in England extend, at the present time, 30 feet from the trunk, while others, of greater height, have their lower branches not more than half of that length. The rate of growth in Great Britain, after the plants are established, ranges from 16 to 21 inches annually.

There is a physiological circumstance common to the Cedars and Larches, which in the Deodar especially is a most valuable provision, viz., the fasciculation of the leaves, which is really an arrested bud, so that when the leader or terminal branchlets have not ripened their wood sufficiently to enable them to pass through a severe winter without injury, or when injured by other causes, a new leader and fresh branchlets are formed from the arrested buds in immediate proximity to the injured part. The repair of injuries by the Deodar is very rapid. Another interesting feature may be observed in the pendulous leader which changes its direction every year. "It makes a complete revolution in three years, and so ascends like a screw."†

* Earl Ducie in *Trans. Scotch Arb. Soc.*, 1874. † Lawson's *Pinetum Britannicum.*

The strength and durability of the timber of the Deodar has been already adverted to.* In addition to these qualities, the grain is fine, and bears a high polish; the wood is also delightfully fragrant, and free from the attacks of insects. So highly is Deodar timber prized by the inhabitants of the Himalayas, that "although having within their reach every variety of tree and its timber, they select that of the Deodar, and prefer it to all others for the construction of their houses, temples, and bridges. It is used not only as timber is commonly used, under cover, but for the verandahs, and the roof, as well as the exterior frame-work of the roof. Their bridges are wooden bridges, formed of Deodar timbers overlapping each other, until they meet in the centre, the other ends being steadied by being sunk into the bank, and kept down by a great weight. In Cashmere, the Deodar is also employed for making the piers of the bridges on which the arches rest, as well as for building houses and mosques." †

The excellence of Deodar timber is proved beyond all doubt; but the inaccessible situation of the forests, and the cost of transport, are at present insuperable obstacles to its general use in this country. Whether the trees, growing in Britain will yield timber as good as that afforded by native trees, can only be determined by time, and as yet, no trees of sufficient age and size exist in this country to furnish any criterion of the quality the timber may prove to possess in its maturity. It must be remembered also, that the Deodars in Great Britain are growing under climatal conditions very different from what they are on the Himalayas, where "for nearly half the year they are enveloped in snow, and where from the middle of March to the middle of June there is considerable dryness in most of the situations; from the middle of June to the middle of September there is a cloudy atmosphere, almost continual rain, and great moisture of the climate; in autumn there is fine clear weather," ‡ These changes in the seasons of the Himalayan regions are said to recur with tolerable constancy year after year; whereas, in Britain, in no two consecutive years are the seasons precisely alike; often they are very different. But while the extremes of temperature occurring in the Himalayan regions enable the Deodar to bear all the vicissitudes of our climate, it cannot be safely inferred that the timber of the trees growing in this country will equal that of the native forests.

The specific name *Deodara* or *Devadara*, is a native word indicative of the connection of the tree with sacred objects and worship. It is said to be derived from two Sanscrit words: *deva*, a deity, and *dara*, wood.

* *See* page 17.

† Report of Dr. Royle to Her Majesty's Commissioners of Works.

‡ Dr. Royle, *idem.*

Cedar of Lebanon in Goodwood Park.

Planted in 1761. Present height (1881) about 65 feet; length of principal branches from 40 to 50 feet.

Cedrus Libani.—The Cedar of Lebanon has been called "The Patriarch of the Tribe," and there are few persons who have once seen it when it has reached an age sufficient to develop its majestic form that would deny the appropriateness of the title. Its peculiarly distinct aspect renders it one of the most easily recognized of all trees. The trunk is massive and much branched, attaining but a moderate height; the branches are horizontal, rigid, tabuliform, disposed in distinct whorls or stages, and long in proportion to the height of the tree, so that the habit is spreading and quite different from the pyramidal spiry growth of the Firs. The branchlets grow from their primaries in a flat fan-like manner, and are very numerous and thickly set. The foliage is dense, and at first of a bright green, which changes, by age, to a deep grass green and slightly glaucous; but sometimes the glaucous hue is gradually heightened, year after year, till the leaves become almost of silvery whiteness, imparting to the tree a truly venerable and hoary aspect. The leaves are straight, slender, about 1 inch long, on short foot-stalks, tapering to a point, and persistent about two years. The cones are ovate oblong, from 3 to 5 inches long and from 2 to 2½ inches broad.

Habitat.—The mountains of Syria and Asia Minor, especially Lebanon and that portion of the Tauric range which extends through Cilicia.* Also in the island of Cyprus on the mountain near Khrysokus.†

Cedrus Libani argentea differs from the common form only in its highly glaucous foliage, as described above. It occurs in a wild state (on Mount Taurus) as well as in cultivation.

Several specimens of extraordinary beauty are growing at The Poles, near Ware, Hertfordshire, the residence of Robert Hanbury, Esq., long known as a liberal patron of horticulture. The foliage of these trees is of silvery whiteness, and presents a striking contrast to the green of the surrounding trees.

The date of the introduction of the Cedar of Lebanon into England cannot be fixed with certainty; it is not mentioned in Evelyn's *Silva*, written in 1664, but there is evidence to show that its introduction was effected very shortly afterwards. One of the oldest Cedars in England is standing in Bretby Park, Derbyshire; this is known to

* In Monte Tauro præsertim cilicio sylvas vastas construens.—*Prod.*, xvi., p. 408.

† The discovery of the Cedar in Cyprus is quite recent. It appears to be confined to one spot, and to differ from the known form in having shorter leaves and smaller cones.—*See* paper by Sir J. D. Hooker in the *Journal of the Linnæum Society*, vol. xviii., p. 517.

have been planted in 1676. There are many other old trees in England and among them, some of the finest in Europe.*

The economic value of the Cedar of Lebanon in modern times, otherwise than for ornamental planting, is inconsiderable; the timber of trees felled in Britain is inferior; "the wood is light, soft, brittle, apt to warp, and by no means durable."† There are, however, grounds for believing that the Cedars growing under very different circumstances of climate in proximity to the snows of Lebanon and Taurus yield timber of the finest quality. In the expedition to Mount Lebanon, undertaken by Sir J. D. Hooker, Captain Washington, R.N., and other gentlemen, in the autumn of 1860, "a section of the lower limb of one of the oldest trees (which lay dead on the ground) was procured, which gave a totally different idea of the hardness of Cedar-wood from what English specimens do."‡

The secretions of the Cedar of Lebanon are not abundant, but they appear to possess very remarkable properties, some of which were known in very ancient times; the Egyptians are said to have used its whitish resin in embalming their dead; and Pliny states that books were sometimes perfumed with it.§ The most recent notice of these properties appears in Mr. Smee's entertaining book, *My Garden*, p. 429: "The wood of the Cedar contains a volatile essential oil, which has the curious property of unsettling printers' ink and making it run. Some years ago a Bank of England note was offered to the cashier with its printing disturbed. Inquiry was set on foot, and it was traced to several individuals who satisfactorily explained its custody and possession. It was then brought to me, when I suggested that the detectives should inquire whether it had been kept in a Cedar box; it was then discovered that the last possessor had kept it in a new Cedar box, which she had recently bought, and thus the mystery was solved."

The specific name *Libani* refers to the ancient mountain with which the tree has been associated from remote antiquity, and especially in the Sacred Writings. The Cedars on Mount Lebanon have thence acquired a separate and special interest throughout the Christian world. Since the Reformation they have been visited from time to time by travellers from western Europe, most of whom have left some account of the trees they found standing at the time of their visit. These accounts agree as to their majestic proportions and venerable aspect; they also contain evidence that the once famous forest, which clothed the mountain side, has diminished to a small grove, whose extent can

* The Cedars at Syon House, Warwick Castle, Linton Park, Chiswick, Goodwood Park, Gunnersbury, Blenheim, &c.

† Loudon, *Arb. et Frut.*, p. 2417.

‡ *Gardeners' Chronicle*, p. 67, 1862.

§ Resinam albidam olim sub Cedriæ nomine ad libros cedratos et ut videtur, ad cadavera antiquorum Ægiptiorum preservanda usitatissimam scatens.—*Prod.*, xvi., p. 408. Libri cedrati occurs in *Pliny*, 13—27, but the reading is disputed.

be traversed in a few hours, and every individual Cedar within it measured and its position mapped down. The information given in these reports further leads to the conclusion that the number of Cedars will continue to diminish till the grove itself has become extinct.

From the account of the expedition to Mount Lebanon, above referred to, published by Sir J. D. Hooker in the *Natural History Review*, for January, 1862, we obtain the following very interesting particulars:—

"The Cedars are confined to one spot at the head of the Kedisha Valley; they have, however, been found by Ehrenberg in valleys to the northward of this. The Kedisha Valley, at 6,000 feet elevation, terminates in broad, shallow, flat-floored basins, and is 2 to 3 miles across; it is in a straight line 15 miles from the sea, and about 3 or 4 from the summit of Lebanon, which is to the northward of it.

"The Cedars form one group, about 400 yards in diameter, with an outstanding tree or two not far from the rest, and appear as a black speck in the great area of the corry and its moraines, which contain no other arboreous vegetation, nor any shrubs, but a few small Berberry and Rose bushes, that form no feature in the landscape.

"The number of trees is about four hundred, and they are disposed in nine groups; they are of various sizes, from about 18 inches to upwards of 40 feet in girth; but the most remarkable and significant fact connected with their size, and consequently with the age of the grove, is, that there is no tree less than 18 inches in girth, and that we found no young trees, bushes, nor even seedlings, of a second year's growth. We had no means of estimating accurately the ages of the youngest or oldest tree. It may be remarked, however, that the wood of the branch of an old tree, cut at the time, is 8 inches in diameter (exclusive of bark), presents an extremely firm, compact, and close-grained texture, and has no less than one hundred and forty rings, which are so close in some parts, that they cannot be counted without a lens. Calculating only from the rings on this branch, the youngest trees in Lebanon would average one hundred years old, the oldest two thousand five hundred years old, both estimates, no doubt, widely far from the mark. Calculating from trunks of English rapidly grown specimens, their ages might be estimated as low respectively as five and two hundred years; while from the rate of growth of the Chelsea Cedar, the youngest tree may be twenty-two, and the oldest six to eight hundred years old.

"The positions of the oldest trees afforded some interesting data relating to the ages of the different parts of the grove, and the direction in which it had lately spread. There were only fifteen trees above 15 feet in girth, and these all occurred in two of the nine clumps, which two contained one hundred and eighty trees. Only two others exceeded 12 feet in girth, and these were found in immediately adjoining clumps, one on one side and one on the other of the above

mentioned. There were five clumps, containing one hundred and sixty-six trees, none of which were above 12 feet in girth, and these were all to the westward of the others. On this side, therefore, the latest addition to the grove had taken place."

A journey to the Cedar Grove on Mount Lebanon was undertaken in the autumn of 1878, by Captain Oliver, late Royal Artillery, from whose narrative, published in the *Gardeners' Chronicle*, for August, 1879, we extract the following paragraph:—"There are exactly three hundred and eighty-five trees, large and small, but the smallest must be at least from fifty to eighty years old, and no younger trees are springing up. At this time of the year innumerable seeds, which are scattered everywhere beneath the trees from the fallen and expanded cones, are germinating, scattered by the winds; these germinating seeds extend far beyond the actual area covered by the remaining trees; and if it were not that they are trodden under foot, or what is still more destructive, eaten by the goats, a few decades of years would soon see a fair sprinkling of healthy young Cedars enlarging the borders of the grove. At present, for want of proper protection against the goats, and thoughtless tourists, the present grove is dwindling away; and another generation will exclaim against our supineness in thus allowing a relic of the past to die out prematurely."

IV.—PINUS (*Linnæus*). The Pine.

The Pines are mostly tall trees with rounded tops, and with branches generally shortened; they are easily recognised by their long needle-like, semi-terete, or triquetral leaves, which are produced in bundles of twos, threes, and fives, enclosed at their base in membranous sheaths that are deciduous in some species and persistent in others. All the Pines are evergreen, the foliage of some kinds remaining on the trees for several years. The male flowers are produced at the extremities of the branches, frequently in dense spikes or clusters; the female flowers are also terminal, sometimes solitary, but not unfrequently in whorls or fascicles. The cones of the different species differ considerably in size and shape, but all have persistent scales and remain on the trees for a long period after they have shed their seed, which, in most species, is ripened in the second season. Each scale produces two seeds, which in some species are winged, in others not.

The cones of Pinus are distinguished from those of Abies by the hard ligneous texture of their scales, and which, in most of the species,

are much thickened or swollen at their exterior terminal part.* The form this part assumes differs in the different species, and is, therefore, regarded by Botanists as an important character in the determination of species. In some species this exterior terminal part of the scale is regularly pyramidal and sharply pointed, sometimes it terminates in hooked prickle; in others it is simply a rounded protuberance or umbo, while in the Strobus and Cembra sections it is almost smooth.

The Pines include more species than any other genus in the Order, and are distributed over a greater geographical area. Not many more than half of them are hardy in Great Britain, and the number available for planting may be diminished by the rejection of several kinds, chiefly American, that possess no qualities to recommend them for horticultural or arboricultural purposes.

The economic value of the Pines is very great. Many species afford timber of the highest importance in constructive work, and Pine timber is the staple article of commerce with many ports of northern Europe and British North America. The secretions of many species are also very abundant, from which pitch, tar, turpentine, and resin are [illegible]ied in immense quantities. The products and principal uses of the most important species will be noticed under their descriptions. In arboriculture, as in landscape planting, some of the most ornamental and picturesque of trees are to be found among the Pines, while other species are greatly valued as *nurses* for more tender trees—for forming screens, &c. So various are the soils and situations in which the different species occur in their native countries, that there is scarcely a spot for which one or other kind is not suitable; thus, the Scotch or wild Pine grows on the bleakest hills; *Pinus Pinaster* flourishes in shallow sands near the sea-shore; *P. rigida* attains its greatest perfection amidst the Cedar swamps of Virginia; *P. ponderosa* grows in the arid plains of Utah, where no other vegetation exists; and the Scrub Pine (*P. Banksiana*), straggles over the rocks in the cold and sterile countries east of Hudson's Bay.

The Pines admit of a division into three Sections, according to the number of leaves in a sheath, thus—

1. Binæ, with two leaves in each sheath.
2. Ternæ, with three leaves in each sheath.
3. Quinæ, with five leaves in each sheath.†

* This part is called, in the language of Botany, the *apophysis*.

† We adopt this Sectional Division on account of its obvious simplicity, and as being that most available for practical uses. The true affinities of the Pines will be best sought for in the fructification, to which the number of leaves in a sheath can only be regarded as a subordinate character.

Pinus is the Latin name of the Pine, and was applied indiscriminately by the Roman authors to the species indigenous to Italy and southern Europe. Pinus is derived from or allied to the Greek πίτυς (pitus), which has for its root *pi* or *pin*, meaning richness or fatness, whence *pitus*, in reference to the abundant secretions of the Pines.

Section I.—Pines with Two Leaves in a Sheath.

This section includes several species valuable for their timber, not only in the countries of which they are natives, but also as supplying a large proportion of the timber of commerce; as the Scotch or Wild Pine of northern Europe, the Corsican Pine of southern Europe, and the Yellow Pine of America. Others are ornamental and highly picturesque trees, as the Pyrenean Pine and the Italian Stone Pine. The greater number of them have rigid greyish foliage, comparatively short leaves, and small ovate cones of a dull ash-brown colour. *Pinus Pinaster* and *P. resinosa* have long leaves; *P. pyrenaica*, *P. halepensis*, *P. contorta*, and one or two others have bright green foliage; and *P. pinea* has large yellowish-brown cones. With the exception of *P. Merkusii*, all the two-leaved Pines are extra-tropical, and are generally distributed over the northern portions of both hemispheres. All the European species, except *P. Cembra*, belong to this section.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PINUS Austrìaca (*Höss*)	*Pinus nigra* (Link) ,, *Laricio austriaca* (Endlicher) ,, ,, *nigricans* (Parlatore)	The Austrian Pine	Austria	75—100
Banksiàna (*Lambert*)	,, *hudsonica* (Poiret) ,, *rupestris* (Michaux)	Sir Joseph Bank's Pine	British North America	5— 12
Bolandèri (*Parlatore*)	... ...	Bolander's Pine	California ...	12— 15
contòrta (*Douglas*)	,, *Boursieri* (Carrière)	...	,,	25— 30

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PINUS DENSIFLÒRA (*Siebold*)	*Pinus japonica* (Antoine)	The Japanese Pine	Japan	40— 50
HALEPÈNSIS (*Aiton*)	... ...	The Aleppo Pine	The Mediterranean region	40— 45
ÌNOPS (*Solander*)	,, *virginiana* (Miller) ,, *variabilis* (Lambert)	The Scrub Pine	Eastern United States	25— 40
LARÌCIO (*Poiret*)	,, *corsicana* (Hort.)	The Corsican Pine	Southern Europe	100—140
,, caramanica (*Loudon*)	,, *caramanica* (Hort.)	...	...	25— 40
,, pygmæa (*Rauch*)	,, *Laricio nana* (Hort.)	The dwarf Corsican Pine	...	6— 8
MASSÒNIANA (*Lambert*)	,, *Thunbergii* (Parlatore)	Masson's Pine	Japan	70— 80
MÌTIS (*Michaux*)	,, *echinata* (Miller) ,, *variabilis* (Pursh)	The Yellow Pine	Eastern United States	50— 60
MONOPHYLLA (*Torrey*)	,, *Fremontiana* (Endlicher)	...	California ...	20— 25
MONTÀNA (*Duroi*)	,, *Pumilio* (Hænke) ,, *uncinata* (Raymond) ,, *Mughus* (Loudon) ,, *humilis* (Link) ,, *obliqua* (Sauter) ,, *uliginosa* (Wimmer) ,, *carpatica* (Hort.)	The Mountain Pine	The Alpine regions of Europe	5— 15
MURICÀTA (*Don*)	,, *Edgariana* (Hartweg) ,, *Murrayana* (Balfour)	The Bishop's Pine	California ...	25— 40
PALLASIÀNA (*Lambert*)	,, *Laricio Pallasiana* (Loudon) ,, *taurica* (Hort.)	The Crimean Pine	The Crimea ...	60— 80
PINÀSTER (*Aiton*)	,, *maritima* (Lamark)	The Cluster Pine	S. & S.W. Europe	40— 60
,, brutia (*Sprengel*)	,, *brutia* (Tenore)	The Calabrian Pine	Calabria ...	60— 70
,, Hamiltonii (*Lindley*)	,, *Escarena* (Hort.) ,, *Hamiltonii* (Tenore)	Lord Aberdeen's Pine	Piedmont ...	30— 40

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PINUS PÌNEA (*Linnæus*)	... ...	The Stone Pine	Southern Europe	50— 75
PUNGENS (*Michaux*)	... ...	The Table Mountain Pine	Virginia & North Carolina	40— 50
PYRENÀICA (*Lapeyrouse*)	*Pinus hispanica* (Cook)	The Pyrenean Pine	The Pyrenees & Spanish Sierras	60— 80
RESINÒSA (*Solander*)	,, *rubra* (Michaux)	Canadian Red Pine	Canada to Pensylvania	60— 80
SINÈNSIS (*Lambert*)	,, *Massoniana* (Parlatore)	The Chinese Pine	China	40— 60
SYLVÈSTRIS (*Linnæus*)	... ...	The Scotch or Wild Pine	Northern Europe and Asia	75—100
,, argentea (*Hort.*)	... ...	...	Garden variety	
,, aurea (*Hort.*)	... ...	...	,, ,,	
,, horizontalis (*Don*)	... ...	...	Wild variety ...	100—120

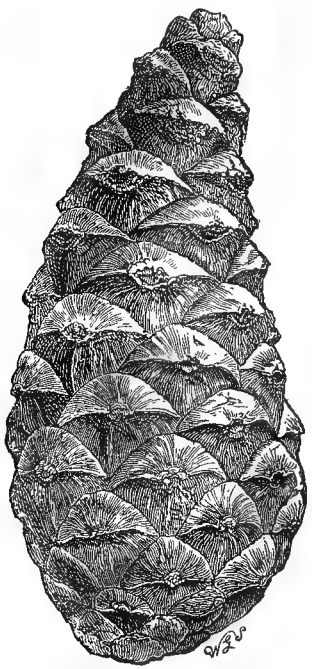


Fig. 36.—Cone of *Pinus austriaca*. Natural size.

Pinus austriaca.—A tree of rapid growth, with stout branches, rather longer in proportion to the trunk, than in most of the Pines in this section. The whorls of branchlets are densely clothed with blackish green foliage; the leaves are rigid, sharp-pointed, rough at the edges, rounded on one side, slightly channelled on the opposite, and from 4 to 5 inches long. The aspect of the Austrian Pine is sombre and massive, whence it obtained the name of *Pinus nigra*.*

Habitat.—The mountains of Carniola, lower Austria, Moravia, Transylvania, and other provinces of the Austrian Empire.

Introduced into Great Britain in 1835, by Messrs. Lawson, of Edinburgh.

* The Austrian Pine is described by Parlatore as a variety of *Pinus Laricio*, "foliis crassioribus rigidioribus fusco-viridibus." *Prod.* xvi., p. 387.

The wood of the Austrian Pine is very resinous, strong, and tough, but coarse in grain and knotty; it is inferior to that of the Scotch or Corsican Pine, but useful for out-of-door carpentry, as fencing, &c. As a fast growing dense habited tree, it is one of the best of Pines for forming screens, and for "nursing" more tender trees. It is perfectly hardy, and thrives in any soil not too wet; it also grows well on chalk hills where many other kinds fail, but it should not be planted in proximity to the sea.

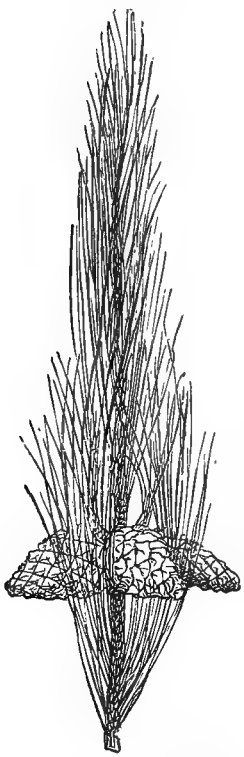


Fig. 37.—Fertile branchlet of *Pinus austriaca*. One-fourth natural size. (From the *Gardeners' Chronicle*.)

Pinus Bolanderi.—A low tree, rarely exceeding 15 feet in height, much branched, and densely clothed with foliage. The leaves are about 2 inches long, rather rigid, twisted, sub-erect, and palish grass-green in colour; the cones are small, ovoid, about 2 inches long, and are produced in whorls of four—five.

Habitat.—California, on the upper portions of the coast range, in the neighbourhood of Cape Mendocino.

Pinus Bolanderi is closely allied to, and much resembles *P. muricata*, of which it is probably only a local and smaller form. Its dense branching habit and bluish grey glaucescent foliage render it distinct as a low shrubbery tree, and useful for thick screens; it should not be planted in exposed situations.

Pinus contorta.—A tree of moderate or small size, of conical outline, with numerous sub-erect or spreading branches. The leaves are small, not more than from 1 to 2 inches long, closely resembling those of the Scotch Fir in form, but of a brighter green; the cones are ovoid, almost spherical, about 1½ inch long, and persist for several years.

Habitat.—California and Oregon, abundant on the Cascade Mountains, and on the banks of the Klamath and Columbia Rivers.*

Introduced by David Douglas in 1831.

Pinus contorta is a hardy useful Pine for the park and landscape,

* *Pacific Railway Report*, p. 34.

and also for lawns, where much variety is desired. In its young state in this country it is a compact, pyramidal, densely branched tree, with the branches much twisted or gnarled, and well furnished with grass-green foliage.

Dr. Newberry *(Pacific Railway Report)* thinks that the specific name *contorta* was suggested to Douglas by the curious appearance of some of the dead trees standing on the pumice plain which lies between the Klamath lake and the Des Chutes River; the branches of these trees curve downwards and inwards, thus reversing the natural upward curve of their extremities while living.

Pinus densiflora.—A tree of medium height, with a tapering trunk, covered with rough furrowed bark. The branches of the young trees growing in Great Britain are robust, ascending, and clothed with dusky brown bark, roughened with the bases of the persistent scales. The leaves are from 3 to 4 inches long, rather stiff, rounded above, channelled beneath, slightly scabrous or roughish, bright green, and crowded towards the extremities of the branchlets. The cones are about 2 inches long, somewhat smaller than those of the Scotch Fir, and with thinner scales.

Habitat.—Japan, common in the islands of Nippon, Kiusiu, and Sikok.

Introduced into Europe by Siebold & Co., of Leyden, in 1854.

Pinus densiflora and *P. Massoniana*, are the common species of Japan; their wood is not distinguished by separate names, both are known as Mats, which is the Japanese name for Pine. The timber is of good quality, and much used in constructive work. So highly are these trees esteemed by the Japanese that they represent them on lacquer and porcelain ware; they plant them in their gardens and by the sides of the public roads. (*See* notes on *P. Massoniana* p. 149).

The specific name *densiflora* refers to the male catkins, which are clustered into a thick cylindrical spike 2 to 3 inches long.

Pinus halepensis.—A tree of medium height, with a spreading open head and slender branches covered with smooth cinereous bark. The leaves are from 3 to 5 inches long, slender, and rather light green in colour, clustered at the extremities of the branchlets, not unfrequently produced in threes, and persistent not more than two years, from which cause the trees have a rather bare and thin appearance. The cones, which are produced while the trees are quite young, are at first acutely conical, from 2½ to 3 inches long, but after the fall

of the seed much shortened and rounded through shrinking. The scales are broad, flat, smooth, and yellowish-brown, with a greyish tinge when mature.

Habitat.—The Mediterranean region, from Portugal to the Levant; also western Asia as far as Georgia and even Persia; on Mount Hebron in Palestine, and other parts of Syria.*

Introduced into England in 1663, by Bishop Compton.

The wood of the Aleppo Pine is white and fine in grain; it is much used in joinery throughout the extensive region in which it is abundant. The secretions are very copious, and the turpentine and resin procured from them are preferred to those obtained from *Pinus Pinaster*, the common Pine of the south-west of Europe. In some parts of Italy, especially in the Riviera, the leaves are used by the people of the country in their stables instead of straw.

Pinus halepensis thrives among the rocks on the Mediterranean shore, where comparatively few other trees find subsistence; the stems and branches often assume the most fantastic contortions, from the direction given to the south-west wind by rocky angles exposed to it. In England it requires a sheltered situation.

Pinus Laricio.—A tall, fast-growing tree, with a straight trunk furnished with comparatively few and short branches, and which, when standing singly, has a very elongated pyramidal outline. The leaves are of variable length, the longest being about 6 inches, and frequently twisted. The cones are about the same size, and closely resemble those of *P. austriaca*. (*See* fig. 36.) This Pine is easily recognised by its strict, erect habit, shortened branches, which sometimes show a tendency to curve in a direction round the tree and upwards, and by its large twisted glaucous foliage.

Habitat.—Southern Europe, and many parts of western Asia; the islands in the Mediterranean Sea, particularly Corsica, Sardinia, and Sicily.†

Introduced into England in 1759, under the name of *Pinus sylvestris maritima*.

Pinus Laricio caramanica is said to attain scarcely half the height of the common form. As seen in British gardens it is a low tree with a divided trunk, much branched, and of rather dense habit.

* Carrière, p. 506.

† Very common on Mount Etna, from 4,000 to 6,000 feet elevation.

Pinus Laricio pygmæa is a dwarf dense bush with all its branches and their ramifications much shortened, and with the foliage clustered in thick tufts at their extremities.

Other varieties of *Pinus Laricio* have received the names of *compacta, contorta, nana, pendula,* &c.

"The Corsican Pine is well adapted for profitable planting in this country. For quality, quantity, general utility, and early maturity it may have equals, but no superiors among the true Pines. It is constitutionally hardy, of very rapid growth, surpassing its congeners, and a rival to the now diseased Larch; of large dimensions, attaining heights of from 80 to 130 feet; arriving at maturity in sixty to eighty years, but will produce timber fit for any purpose in about thirty or forty years. It is not fastidious as to soil or situation, and excepting in spongy marsh or soft peat, there is no description of soil not surcharged with stagnant water in which it would not grow and produce wood of as good quality and equal quantity, and yield as quick and profitable a return as any timber tree extant.

"Its wood when young, or newly cut, is creamy white; when matured and seasoned, brownish yellow; very resinous, elastic, and tough; very durable, long grained, and though a little coarse in texture, is easily worked and capable of receiving a tolerably good polish. It is less subject to the ravages of insects, fungi, game, or vermin than any other Pine, which may be accounted for by the bitter aromatic flavour with which its juices are impregnated."

It is a sparse tap-rooted Pine when in a young state, but it is not on that account bad to transplant. If the seedling plants are transplanted in the autumn or winter, after their first summer's growth, and again every succeeding autumn or winter till removed to their permanent quarters, the failures are nil.*

The specific name *Laricio* is the common name of the tree in southern Europe. It is often called the Corsican Pine in England, for no assigned reason, except that considerable quantities of seed have been received from the island of Corsica.

Pinus Massoniana is usually described as a larger tree than *P. densiflora*, with which it is associated, and which it closely resembles. The trunk attains a greater height, the branches are longer and more spreading, the branchlets stouter, and the foliage of a brighter green. The leaves are from 4 to 6 inches long, rounded or convex above, channelled beneath, abruptly pointed,

* Senilis in *Gardeners' Chronicle* of 1865, p. 891. See also *Proceedings of the Scotch Arboricultural Society*, 1873, where *Pinus Laricio* is recommended as the best substitute for Larch where the latter fails in consequence of disease.

twisted, and deep green, the edges slightly scabrous. The cones are among the smallest in the true Pines, and are not distinguishable in structure from those of *P. densiflora*.

Habitat.—Japan, throughout the whole extent.

Introduced into Europe by Siebold & Co., of Leyden, in 1854.

The following extract from Siebold's *Flora Japonica* gives a highly interesting description of a practice peculiar to Japanese horticulture, which appears to have been in vogue for many years, probably for centuries past.

"The art of the Japanese gardener has exhausted itself in the cultivation of this Pine and *Pinus densiflora*. They clip and cut them in all manner of ways; they stretch out the branches like a fan, upon horizontal espaliers, or give to the branches the form of a flat plate. In that artificial culture extremes meet—surprise is equally sought to be gained by specimens of immense extent as by others reduced to the most minute dimensions." During Siebold's sojourn at Osaka, he went to see the celebrated Pine before the Naniwaja Tea-house, of which the branches, artificially extended, have a circuit of 135 paces. Another remarkable instance of this artificial cultivation was seen by Mr. Maries at Lake Bi-wa, near Kieoto, in Nippon. The main trunk of the tree is 28 feet in circumference. At about 10 feet from the ground, this divides into three primary branches, which have been made to spread out horizontally, and the circular space covered by them and their appendages is fully 60 yards in diameter. On the other hand, they showed him, in Jeddo, a dwarf tree in a lacquered box of which the branches did not occupy more than 2 square inches.

"The wood of *Pinus Massoniana* is resinous, tenacious, and durable; it is chiefly used in the construction of buildings. The Japanese also make charcoal of it. The soot which they procure from it by burning its resinous roots with the oil of the Turnip *(Brassica orientalis)*, is said to be employed in making the famous Chinese ink, which is manufactured principally in the convent of Nara, in the province of Janato."

Siebold and Zuccarini have described and figured *Pinus densiflora* and *P. Massoniana* in their *Flora Japonica* as two distinct species, in which they are followed by Murray (*Pines and Firs of Japan*) and Parlatore (*D. C. Prod.*, xvi., p. 388), except that the latter author has named the second of the two *P. Thunbergii*, and applied the name *Massoniana* to the *P. sinensis* of Lambert. Mr. Murray remarks that "it is not without great hesitation that he has recorded the two as distinct," and points out the characters by which they may be distinguished, but which appear to have been derived chiefly from an examination of dried specimens, or from Siebold's figures. Our collector,

Mr. Maries, during his recent travels in Japan, had ample opportunities of observing the common Pine of the country, both in its wild state and in cultivation, but failed to distinguish two well defined forms or species. Individual trees, and of these not a few, were to be met with fully answering to the general description of *P. densiflora*, and others that of *P. Massoniana*, but the intermediate forms immensely outnumber them, so that it is impossible to say which of them should be called *P. densiflora* and which *P. Massoniana*. Like all Conifers that have been long under cultivation, the common Pine of Japan is polymorphous, a property the Japanese horticulturists have not failed to observe and to take advantage of, and have distinguished varieties by specific names, as is frequently done by European horticulturists in the case of other Coniferæ.

The common Pine of Japan has proved quite hardy in Great Britain. It is more nearly allied to the Pinaster than to any other of our common Pines, but being quite distinct both from the European and from the American types of the Pinaster section, it is a useful addition to our hardy Pines for the park and landscape, and for planting in proximity to the sea coast.

The specific name *Massoniana* was given by Mr. Lambert, in compliment to Mr. Francis Masson, who brought the first dried specimens to Europe from the Cape of Good Hope, obtained from plants raised from seed which had been sent from China; but it is far more probable that these were *Pinus sinensis*, and hence the change in nomenclature made by Parlatore.

Pinus monophylla is one of the smallest of the Californian Pines. It is an Alpine species, rarely exceeding 20 feet high, and has a dense bushy head and glaucous foliage; the branches are very numerous and slender; the leaves, one to two inches in length, thick at the base, attenuated towards the extremity, and terminating in a sharp point. The leaves of *P. monophylla* present a curious anomaly not met with in any other true Pine; in young plants, and on the young growth of older ones, they are solitary, but they are subsequently produced in twos, and even in threes. The cones, which are about 2½ inches long, are composed of thick ligneous light brown scales, each containing two large ovate wingless seeds that are edible and have a pleasant flavour.

Habitat.—California, abundant on the Sierra Nevada.

Introduced by Hartweg, in 1847.

The specific name *monophylla*, from μόνος (monos) "single," and φύλλον (phullon) "a leaf," refers to the peculiarity of the leaves noticed above.

Pinus montana is a dwarf, densely branched, bushy Alpine tree, variable in height and appearance. The lower branches are generally decumbent, but those above are ascending or quite erect; the leaves are short, stiff, close-set, of a dull green, and slightly glaucous; the cones are small, ligneous, ovoid bodies, about 1½ inch long, with a pyramidal protuberance on each scale on the outer or exposed side.

Habitat.—The sub-Alpine regions of central Europe, at elevations between 4,000 and 7,500 feet; also on the Carpathian Mountains and the Pyrenees.

Introduced into England in 1779 by John Blackburn, Esq., of Warrington.

This Pine is known in gardens by several names, as *Pinus Mugho*, *P. uncinata*, *P. Pumilio*, &c., that were in the first instance given to the forms occurring in the different mountain regions over which it is spread; but all these forms are now acknowledged to be but varieties of one species.

The specific name *montana* refers to its habitat.

Pinus muricata.—A very distinct Pine, of medium size, rarely found to exceed 40 feet in height, but generally much less. Its habit is somewhat irregular, owing to the branches not being numerous, and their growth unequal. The foliage is dark green, with a slight glaucescence which gives it a bluish tint. The leaves are from 4 to 6 inches long, rounded or convex on one side, slightly concave on the other, obtusely pointed, and with rough edges; in the young plants they are thickly set and spreading; on the older plants shorter, more rigid, and more erect. The cones are produced at a very early age of the tree, either singly or clustered round the stem in whorls of from three to seven or eight like those of *P. Pinaster*, and persist several years.

Habitat.—California, on the coast range in the neighbourhood of Saint Louis and Monterey, at an elevation of from 3,000 to 4,000 feet.

Introduced into England by Hartweg, in 1846.

The specific name *muricata*, furnished with sharp points or prickles, refers to the cone, many of the outer scales of which terminate in a sharp hooked spine.

Pinus Pallasiana.—A tree of the *P. Laricio* type, with the pyramidal outline less elongated, owing to the lengthening of the branches, and a corresponding diminution in the height of the trunk. It is well furnished with shining deep green foliage, the leaves being about 6 inches long, rigid, erect, or sub-erect, and thickly set towards the extremities of the branches. The cones are somewhat larger than those of *P. Laricio*.

Habitat.—The Crimea, forming forests of considerable extent on the slopes of the mountains in the neighbourhood of the south coast.

Introduced by Messrs. Lee and Kennedy, in 1790.

Although *Pinus Pallasiana* can only be regarded botanically as a variety of *P. Laricio*, it is, in a horticultural sense, quite distinct, and as an ornamental tree for the park and landscape it should be preferred to *P. Laricio*, but never substituted for it if planted for the sake of its timber. According to Loudon,* who quotes Professor Pallas, the discoverer of this Pine, and after whom it has been named, the wood is very knotty and resinous, and very durable, but difficult to form into good planks on account of the number of the knots.

Pinus Pinaster.—A beautiful tree, of pyramidal habit, attaining a height of from 60 to 80 feet, well distinguished by the following characters:—The bark is coarse and deeply furrowed, even in the young trees, and especially towards the base; the leaves are stiff, broad, stout, from 8 to 12 inches long, and of a pleasing bright green colour; and the cones, which when mature are of a yellowish-brown or fawn colour, are produced in dense clusters around the base of the shoots of the current year.

Habitat.—The Mediterranean countries of Europe, chiefly in the neighbourhood of the coast, also in Algiers. It is particularly abundant in the south of Portugal, in many parts of Spain, and in the west and south of France.

Introduced into England by Gerard, in 1596.

Pinus Pinaster brutia.—Although occasionally met with in collections, it is not sufficiently hardy for general use. It is a medium-sized tree, with spreading branches and slender wavy leaves, 9 inches long.

It is a native of Calabria, in the south of Italy.

Botanists are not agreed as to which species the Calabrian Pine

* *Arb. et Frut.*, p. 2209.

belongs. Lambert describes it as distinct under Tenore's name, in which he is doubtfully followed by Loudon, who would refer it to *Pinus Laricio*. Parlatore brings it under *P. pyrenaica*, and Sprengel under *P. Pinaster*, to which its long leaves and clustered cones seem to indicate the nearest affinity.

Pinus Pinaster Hamiltonii is one of the best of the numerous varieties of *P. Pinaster*. In its maturity in this country, it is an elegant well-furnished tree, with rounded top, its leaves being shorter and paler in colour than those of the species.

It was introduced in 1825 by the Earl of Aberdeen, from the neighbourhood of Nice.

The timber of *Pinus Pinaster* is of little use; the wood is soft and soon decays. The resinous products are, however, of great value, and the procuring of them is an important branch of industry in the province of Guienne and other parts of France. So profitable is this source of wealth, that, notwithstanding the abundance of the *P. Pinaster* throughout southern Europe, it is extensively cultivated on the sandy tracts adjoining the Bay of Biscay, where it grows with great rapidity, and soon yields an ample return for the labour bestowed upon it.

"In the departments of the Gironde and Dordogne, the Pine woods afford a most efficacious protection against the encroachments of the sea. Some fifty years ago great apprehension existed of the destruction of the Medoc country by inundation, as the banks of sand, which are the only barriers against it, were observed to be yielding. The idea then occurred of planting *Pinus Pinaster*, in order to bind the sand, and the result has been most satisfactory." *

In Great Britain *Pinus Pinaster* is only useful as an ornamental tree and for shelter, especially in proximity to the sea, as it will grow not only under exposure to the sea breeze, but also in shifting sands, which it is enabled to do by the form taken by its roots. These roots are, as Loudon points out, different in some respects to those of any other Pine in cultivation. "There is a more decided tap root, and when the soil is dry and sandy, it descends perpendicularly into it; in proportion as the perpendicular roots are stronger than those of other Pines, the horizontal roots are weaker, a disadvantage as regards transplanting, but which is more than counterbalanced by its firm hold in the soil, whence it is seldom torn up by the roots by storms." †

There is probably no single species of Pine that has become more widely distributed over the globe than *Pinus Pinaster*, and which has adapted itself more readily to the various conditions of soil and climate

* *Gardeners' Chronicle*, 1871, p. 137. † Loudon, *Arb. et Frut.*, p. 2219.

in the different countries into which it has been introduced. At the Cape of Good Hope, it has made itself at home as much as any indigenous tree, spreading spontaneously over the sandy plains in the neighbourhood of Cape Town, and in other parts of the colony. It has become quite a common tree in many parts of Australia, New Zealand, &c. It has also found its way into China, Japan, northern India, and many other places, whence it has been frequently re-introduced into England as new species under the following names, which sufficiently indicate their origin: *P. nepalensis* (Royle), *P. chinensis* (Knight), *P. japonica* (Hort.), *P. Novæ Hollandiæ* (Loddiges), *P. Novæ Zealandiæ* (Hort.), *P. Sancta Helenica* (Loudon).

Pinaster, literally "Pine-star," in allusion to the rayed arrangement of the cones on the branches.

Pinus pinea, commonly known as the Stone Pine. In southern Europe it is usually a tall and picturesque tree, with a trunk clear of branches to a height of 50 or 60 feet. The branches are spreading, and the branchlets generally ascending, which being confined to the top of the tree, give the head a parasol-like form. The leaves are about 6 inches long, semi-cylindrical, rather rigid, with the edges slightly scabrous, and of a deep green colour. The cones, which are from 4½ to 6 inches long and about 3 inches in diameter, are composed of stout hard ligneous scales, each containing two edible seeds enclosed in a very hard horny shell; they are of a shining fawn or yellowish-brown colour, attain maturity in the third season, and are persistent several years.

Habitat.—Italy and the Mediterranean region generally, both in Europe and Africa; also Portugal, Madeira, and the Canary Islands.

Introduced into England prior to 1548, as it is mentioned in Turner's *Book of Herbs*, published in that year.

The wood of *Pinus pinea* is whitish, moderately resinous, and very light; it is used in Italy and the south of France for joinery and other constructive work. The edible seeds are much used by the Italian peasantry.

The extremely picturesque appearance of the Stone Pine in its maturity, has caused it to be much planted in public and private gardens in the south of Europe, and especially in Italy, from a very early period. In the neighbourhood of Rome are many fine and venerable specimens from 70 to 75 feet high, which always attract the attention of visitors. Artists have frequently availed themselves of its peculiar and striking form to give it a prominent place in the foreground of their pictures; and thus we often find it associated with

porticos, Ionic pillars, fragments of old temples, and other classic objects in the Italian landscape.*

Although one of the first of exotic Pines introduced into England, the Stone Pine is by no means common, owing to its slow growth and comparatively tender constitution. The few specimens that have survived the severe winters that occur at intervals in our climate, show but imperfectly the striking characters that renders the tree so picturesque in southern Europe. The oldest trees in the most favoured spots in this country have not attained half the height natural to the species in warmer climes, and they have the aspect of premature old age and

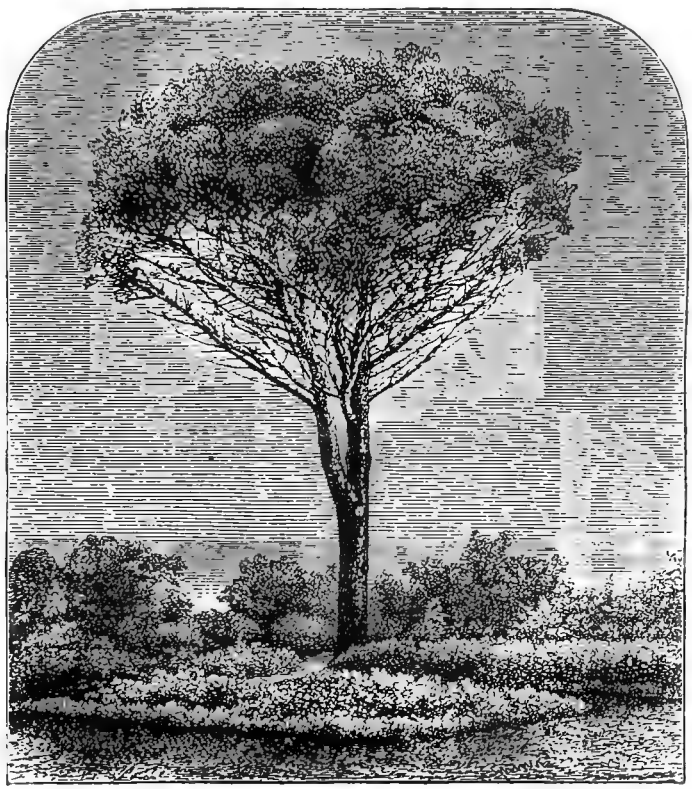


Fig. 38.—The Stone Pine at Glenthorne.

decay. The finest specimen of *Pinus pinea* we have seen is at Glenthorne, in North Devon, the seat of W. H. Halliday, Esq., to whose kindness we are indebted for our illustration. It is 33 feet

* See the picture of Lake Averno, in the Vernon Collection, in the National Gallery, and Childe Harold's Pilgrimage in the Turner Collection, also No. 306 and No. 312 in the same Collection, and many others.

high, the diameter of the head is 22 feet, and the trunk is clear of branches for 15 feet.

The specific name *pinea* was doubtless selected by Linnæus, to express the high estimation in which this Pine is held. *Pinus pinea* is literally "Pine of Pines," The common name Stone Pine was probably given to it on account of the hard shell that encloses the seed.

Pinus pyrenaica.—A handsome tree, of rather rapid growth, forming, in a few years, a fine ornamental specimen with a regular pyramidal outline, and densely clothed with bright deep green foliage. The branches are numerous, and the branchlets close set, the bark of the young growth being of a bright orange colour, by which the species is easily recognised. The leaves are from 3½ to 4½ inches long, often longer on young plants, thin, smooth, and slightly scabrous at the edges. The cones are from 2½ to 3 inches long, and about 1¼ inch in diameter at the thickest part, slightly curved and tapering to a point.

Habitat.—The Pyrenees, chiefly on the Spanish side; also in many places on the Sierras stretching across the Peninsula; in the south of France, especially in the department of Gers.*

Introduced into England in 1834 by Captain Cook (afterwards Captain Widdrington).

Pinus sylvestris.—The Scotch or Wild Pine, one of the most widely distributed and, at the same time, one of the most useful of all Pines. The trunk is erect, often attaining a height of from 80 to 100 feet, and covered with reddish bark; the branches are spreading, but short, the lower ones dying off at an early age, even on trees that stand singly. The leaves on young vigorous-growing trees are from 2 to 3 inches long, but on old trees much shorter; they are at first always of a glaucous green, the glaucescence gradually becoming fainter by age and disappearing in the second year, when they are of a deep sombre green. The cones ripen in the autumn of the second year, and shed their seeds in the following spring.

Habitat.—Central and northern Europe including Great Britain; the Siberian forest region as far as the Amour River.

* And according to Parlatore, "In nemoribus Calabriæ ad 2,400—3,000 ped, hinc inde solitaria; in insula Cypro, insula Creta, frequens in Monte Tauro Caramanico ad 2,500—5,000 ped; in Syria et in Bythinia ubi vastas conficit sylvas."—*Prod.* xvi., p. 384.

Many varieties of the Scotch Pine have been met with, some in a wild state, others in cultivation, all showing some greater or less departure from the usual type. From among the garden varieties we select the following as being the most ornamental:—

Pinus sylvestris argentea, which has the outer halves of the leaves of all the young shoots creamy white, and **P. sylvestris aurea,** which has its foliage golden-yellow. In both cases the variegated portions revert to the normal colour in the second season.

Among the wild varieties, that called *Pinus horizontalis* is the most valued as a timber tree. It is distinguished by its more rapid and more robust growth, by the horizontal direction of its branches, by its broader and more glaucous leaves, and by its producing cones less freely than the common forms. This variety is believed to have been the prevalent form in the ancient Pine forests of Scotland.

"Although native, and with evidence that the greater part of Scotland, north of the Grampians, was covered with the wild Pine at no very remote period, forests of indigenous Firs are at the present time few and far between. The chief remaining ones are to be found about the heads of the valleys of the Dee in Aberdeenshire, and of the Spey in Invernesshire; whilst another, equally beautiful, but perhaps not so well known, lies on the shores of Loch Rannoch, one of the tributary lochs of the Tay in Perthshire. The latter, from its sombre appearance is called by the natives the Black Wood. It lies on the south side of Loch Rannoch, and extends along the shores of the loch for about 2½ miles with an average breadth of about 1 mile; this is about the extent of the dense part of the wood, but including the outlying parts, the length is nearly 7 miles and the greatest breadth 5 miles. In altitude above the sea level the wood lies between 700 and 1,500 feet."*

There is another remarkable natural forest of Scotch Pine at Ballochbuie, on the Braes of Mar, which has now become the property of Her Majesty the Queen, and thus "a guarantee is afforded that it will be permanently preserved as a worthy remnant of those magnificent Pine forests with which the Highland glens and mountains were once so widely clothed."†

The Scotch Pine, from its hardy constitution and rapid growth, is a useful tree for forming screens, and as a nurse for more tender trees. As a tree for planting in poor dry soils and in exposed situations, it is equalled only by the Larch; when planted as a screen for shelter, it is best mixed with the common Spruce and the hardier rapid-

* Dr. F. Buchanan White, in *Gardeners' Chronicle,* 1876, part ii., p. 822.

† William Gorrie, Esq., *Address to the Bot. Soc. of Edinburgh,* 1880.

growing deciduous trees. Its rate of growth in the climate of London, according to Loudon, is from 20 to 25 feet in ten years, and from 40 to 50 feet in twenty years.

The economic value of the Scotch Pine, as a timber tree, is probably not surpassed, in the aggregate, by that of any other tree known. It supplies the yellow deal of commerce, the staple article of trade with many of the Baltic and other ports of northern Europe. Although highly valued as a timber tree in this country, the quality of the timber of home grown trees is inferior to that imported from northern Europe—it is coarser in grain, and much less durable. This inferiority is believed to be due to climatal causes; the long and severe winters of the north are succeeded by short and hot summers, and under these conditions the trees have periods of rest and activity in their growth which they do not get in the more equable climate of Great Britain, and the texture of their wood is affected in a corresponding degree.

The following Pines, belonging to this Section, cannot be recommended for arboricultural purposes in England:—

Pinus Banksiana.—A low, scrubby, straggling tree with tortuous trunk and branches, which are sparingly furnished with short greyish green leaves; it attains a height of from 5 to 8 feet in its native country, but somewhat more in Great Britain. It is the outcast of the family banished to the dreary and inhospitable Labrador and neighbouring countries.

Pinus inops.—An inelegant straggling tree 25 to 40 feet high, with spreading or drooping branches; the young shoots are covered with a purplish glaucous bloom; the leaves are short and glaucous, and the scales of the cones tipped with sharp prickles. Found on sterile and barren hills from New Jersey southward to Kentucky. It is known in America as the Scrub Pine.*

Pinus mitis.—An erect tree from 50 to 60 feet high, producing durable, fine-grained, moderately resinous timber, valuable for flooring; the leaves are from 2 to 3 inches long, soft, slender, and dark dull green. It is a native of the northern New England States and westward as far as Wisconsin; also common southwards as far as Georgia.† In America it is called the Yellow Pine.

Pinus pungens.—A tree 40 to 50 feet high, with the habit and general appearance of the Scotch Pine; the leaves are short, stout, much crowded, and bluish green; the scales of the cones are armed with a strong hooked spine. Found on the Alleghany Mountains;

* *Botany of the United States*, by Dr. Asa Gray, p. 470. † *Idem.*

especially abundant on the Blue Ridge in Virginia and north Carolina. In America it is generally known as the Table Mountain Pine.

Pinus resinosa.—A tall tree of the *P. Laricio* type, 60 to 80 feet high, with reddish smooth bark and dark green leaves 5 to 6 inches long, collected in bunches at the extremities of the branchlets. It occurs in Canada and the adjoining States, where it is commonly known by the name of the Red Pine. "The timber is very durable, its abundant secretions acting like paint in preserving it from decay. The old roots and knots of this Pine, which are of great weight and completely saturated with resin, burn fiercely, give a brilliant light, and are much used for torches." *

Pinus sinensis.—The common Pine of south-eastern China. It is spread over the country where it can be allowed to grow for the supply of timber and fuel, from Canton to the Yang-tse-Kiang; it occurs plentifully on the mountains north of Foo-chow mixed with *Abies Fortunei*. It grows from 40 to 60 feet high, with the aspect of the Japanese *P. densiflora*, but far inferior to that useful Pine. The leaves are in twos, but occasionally in threes, very slender, from 4 to 6 inches long. The cones are those of a Pinaster Pine and are among the smallest in the section.

Section II.—Pines with Three Leaves in a Sheath.

Of the twenty-four or twenty-five Pines belonging to this section, not more than ten or a dozen are available for planting in England, and these for ornamental purposes only. A few species of remarkable aspect have been introduced from the alpine regions of Mexico; but, notwithstanding the high elevation at which they are found in their native country, they have proved to be generally too tender for the climate of England, and, except in Devon, Cornwall, and a few other places, rarely attain the dimensions of large or even medium-sized trees. Very noticeable features, both in these and in some of the more hardy kinds, are the great length of the leaves and the large size of the cones, composed of solid ligneous scales, in many of the species terminating in a sharp point or prickle; but there are some species with short leaves and small cones, as *Pinus Bungeana*, *P. cembroides*, and *P. edulis*.

The Pines in this section are very unequally distributed over the Northern Hemisphere; two-thirds of them are confined to North

* Rowan's *Emigrant and Sportsman in Canada*.

America between latitudes 18° and 45°, the most northern species in the eastern part of the Continent being the Pitch Pine, *Pinus rigida*, and in the western part, *P. ponderosa*. Of the six species known in the Eastern Continent, three occur in the Himalayan region, and one in the north of China, the other two are insular species, *P. canariensis* on Mount Teneriffe, and *P. insularis* in the Philippine Islands. The wood of some of the species is useful for constructive purposes and is known to be very durable, but at present only two supply timber for commerce, the Pitch and southern Red Pines of North America. The resinous products of the same two, and of *P. Tæda*, are procured in immense quantities, of which a large proportion is exported to Europe.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PINUS AUSTRÀLIS (*Michaux*)	*Pinus palustris* (Miller)	The swamp Pine	S.E. United States	60 to 70
BUNGEÀNA (*Zuccarini*)	... ...	The lace-bark Pine	Northern China	60— 75
CEMBROÌDES (*Gordon*)	*Pinus Llaveana* (Schiede) ,, *fertilis* (Rœzl) ,, *Parryana* (Engelmann)	The Cembra-like Pine	South California and Mexico	20— 30
EDÙLIS (*Engelmann*)	... ...	...	New Mexico ...	25— 30
GERARDIÀNA (*Wallich*)	... ...	Capt. Gerard's Pine	Western Himalayas	40— 50
INSÌGNIS (*Douglas*)	*Pinus radiata* (Don)	The remarkable Pine	California ...	40— 80
JEFFREYI (*Balfour*)	... ...	Jeffrey's Pine	California and Oregon	100—150
LONGIFÒLIA (*Roxburgh*)	... ...	The long-leaved Pine	The Himalayas..	60—100
MACROCÀRPA (*Lindley*)	*Pinus Coulteri* (Don)	The large-coned or Coulter's Pine	California ...	75— 90
PÀTULA (*Schiede*)	... ...	...	Mexico	60— 80

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet
PINUS PONDERÒSA (*Douglas*)	*Pinus Benthamiana* (Hartweg) ,, *Sinclairiana* (Hooker) ,, *Parryana* (Gordon) ,, *Beardsleyi* (Murray) ,, *deflexa* (Torrey)	The heavy-wooded or Western Pitch Pine	Western North America	100—150 and upwards.
RÌGIDA (*Miller*)	,, *Fraseri* (Loddiges)	The Pitch Pine	The Eastern United States	50— 75
SABINIÀNA (*Douglas*)	... ...	The Nut Pine	California ...	40— 60
TÆDA (*Linnæus*)	*Pinus serotina* (Michaux) ,, *Elliotti* (Engelmann)	The Torch or Loblolly Pine	S.E. United States	50— 80
TEOCÒTE (*Schiede*)	... ...	...	Mexico	60—120
TORREYÀNA (*Dr. Parry*)	*Pinus lophosperma* (Lindley)	Dr. Torrey's Pine	South California	
TUBERCULÀTA (*Don*)	,, *californica* (Hartweg)	The tuberculated or Monterey Pine	California ...	25— 40

Pinus Bungeana.—A beautiful and distinct Pine, attaining a height of from 70 to 80 feet. The trunk is erect, and in the mature tree, clear of branches to a considerable part of the height, the branches above being long and slender. The bark is smooth, ash-grey on the young shoots, whitish on the trunk, peeling off like that of the birch; the leaves are from 3 to 3½ inches long, thickly placed along the young shoots, pale but bright green, rigid, triquetral or three-angled, compressed and sharply pointed, and with short deciduous sheaths.

Habitat.—Northern China.

Introduced into England in 1846, by the Horticultural Society of London, through their collector, Robert Fortune.

Mr. Fortune gives the following description of this Pine in his

Yedo and Peking. "Near the royal tombstones (at Pekin), I observed a species of Pine tree having a peculiar habit and most striking appearance. It had a thick trunk which rose from the ground to the height of 3 or 4 feet only; at this point some eight or ten branches sprung out, not branching or bending in the usual way, but rising perpendicularly as straight as a Larch to a height of 80 or 100 feet. The bark of the main stems and secondary stems was of a milky-white colour, peeling like that of the Arbutus, and the leaves, which were chiefly on the top of the tree, were of a lighter green than those of the common Pine. Altogether this tree had a very curious appearance, very symmetrical in form, and the different specimens which evidently occupied the most honourable places in the cemetery, were as like one another as they possibly could be. In all my wanderings in India, China, and Japan, I had never seen a Pine tree like this one. What could it be? Was it new? And had I at last found something to reward me for my journey to the far north. I went up to the spot where two of these trees were standing like sentinels, one on each side of a grave. They were both covered with cones, and, therefore, were in a fit state for a critical examination of the species. But although almost unknown in Europe, the species is not new. It proved to be one already known under the name of *Pinus Bungeana*."

This remarkable Pine is still comparatively rare in British gardens. It much resembles the Himalayan, *P. Gerardiana*, but is superior to it as an ornamental tree. It is quite hardy.

Pinus Bungeana is named after Alexander von Bunge, a Russian Botanist, who accompanied Ledebour in his travels through Siberia, and who was afterwards (1830) sent by the Russian Government as naturalist with a mission to Pekin, where he first met with this Pine and many other plants not previously known to Europeans. He subsequently (1836) succeeded Ledebour as Professor of Botany and Director of the Botanic Garden at Dorpat.

Pinus cembroides.—A low Alpine tree, with the trunk often tortuous. The branches and their ramifications are very numerous, imparting a dense habit to the tree; the leaves are about 1½ inch long, triquetral and compressed, rigid, erect or sub-erect, and light glaucous green. Cones ovoid, 2 to 2½ inches long.

Habitat.—The mountains of Orizaba and the Real del Monte in Mexico, at elevations between 8,000 and 12,000 feet; also in south California.

Introduced by Hartweg in 1846.

On the mountains of Orizaba this Pine is said to attain a height

of 30 feet. In England its growth is very slow; all the specimens we have seen of it are much branched and twiggy, well furnished with foliage, but of irregular shape. It is a very distinct Pine, and tolerably hardy.

Pinus Gerardiana.—A medium-sized tree with a conical outline, attaining a height of from 40 to 50 feet; the bark is smooth, greyish, and peels off like that of *P. Bungeana*. The branches are generally ascending, but the lower ones are spreading, and the branchlets short and somewhat slender. The leaves are from 4 to 5 inches long, rather rigid, three-angled, abruptly pointed, and of a glaucous yellowish-green; the sheaths are deciduous. The cones are sub-globose or ovate oblong, with the greater diameter 4 to 5 inches, composed of thick spiny scales, each with two large edible seeds.

Habitat.—The Himalayas, from Afghanistan to Nepaul, at elevations between 8,000 and 10,000 feet.

Introduced into England about the year 1830.

Dr. Aitchison (*Journ. Lin. Soc.*, Nos. 106—107), thus describes *Pinus Gerardiana* as seen in the Kuram district in Afghanistan:—

"A very handsome tree that does not branch as Pines usually do, the trunk and branches being more like those of a well-formed Oak. It is easily recognised at a distance by its nearly white, ash-grey bark, which, on close examination is seen not to be of one colour, but consists of patches of all tints, from light green to autumnal reds and browns; this is due to the peculiar way the bark exfoliates. The nuts are a large article of diet amongst the villagers of the district in which the Pine grows, and a luxury in north-west India."

Named by Dr. Wallich in compliment to its discoverer, Capt. Gerard, an officer in the Bengal Native Infantry. It is tolerably hardy, but its growth in England is slow. Several beautiful specimens, however, are to be met with in the south and west of England, among the finest of which, one in the Pinetum of T. Gambier Parry, Esq., of Highnam Court, near Gloucester, is deserving of especial mention.

Pinus insignis.—A beautiful tree, generally of medium height. When young it is very densely branched, and clothed with a profusion of handsome grass-green foliage; in its maturity it has a rounded top, and long spreading branches with the foliage clustered at the extremities. The leaves are slender, thread-like, twisted, and from 4 to 6 inches long; the cones, which are also very handsome appendages of the tree, are from 4 to 5 inches long, obtuse at the

base, pointed at the apex, and with greater developement on the outer or exposed side; the scales are spineless, smooth, and of a glossy orange-brown colour.

Habitat.—California, in the neighbourhood of the coast, from Monterey to San Antonio, and a few other places.

Introduced in 1833 by David Douglas.

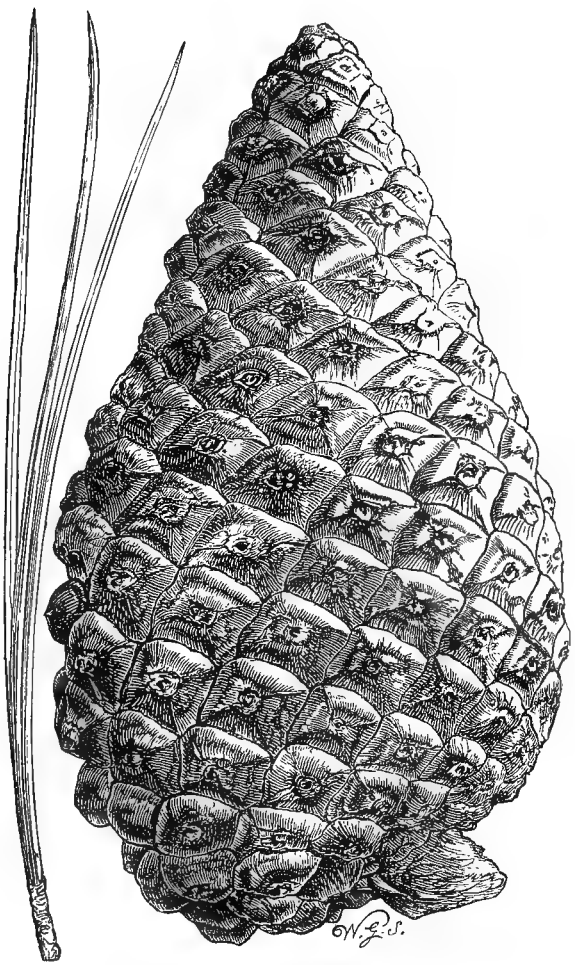


Fig. 39.—Cone and leaves of *Pinus insignis*. Natural size. (From the *Gardeners' Chronicle*.)

This Pine varies much in habit, according to the soil and situation in which it is growing. In the close forests in the neighbourhood of Monterey, it is drawn up to a height of 60 feet without a branch; on the outskirts of the woods, and when standing far apart, it grows a handsome tree, with wide spreading branches from the ground to the summit. At its northern limit, when growing close to the sea-shore, and exposed to the prevailing north-west winds it scarcely exceeds the height of a tall-growing shrub.

Pinus insignis is one of the most ornamental of all the Pines, but it cannot be said to be sufficiently hardy in England, except in the south and south-west, to be relied on as a permanent decorative tree. In the severe winter of 1860-1 more than two-thirds of the trees of this species then existing in Great Britain were killed; and in ordinary winters it does not always escape injury; the foliage is often browned and rendered unsightly by frost and piercing winds, and unripened

shoots are frequently killed. To secure fine specimens of *P. insignis* the young plants must have a sheltered situation or be "nursed" by the more hardy Pines and Firs. As the lower branches of the largest and finest specimens in this country have attained a length of upwards of 30 feet, it is evident that a space having a radius *greater* than this should be provided to allow the tree to develope its fine proportions. Being found on the Californian coast close to the beach, *P. insignis* is one of the few Coniferous trees that will grow under the influence of the sea breeze, but never under exposure to cold winds. This Pine frequently suffers much, especially in its young state, from the attacks of the Pine Beetle (*Hylurgus piniperda*), which seems to prefer it to all others. *See* page 34.

The specific name *insignis*, "remarkable," was selected by Douglas to designate this noble Pine.

Pinus Jeffreyi.—A tall tree, attaining a height of upwards of 150 feet. In its young state in this country, it is a moderately fast-growing Pine, with leaves about 9 inches long, rigid, spreading, and glaucous green. In its maturity in the Shasta valley, it is said to be irregular in outline and bare in appearance, owing to the foliage being tufted or clustered at the extremities of the branches. The cones are large and handsome, 8 or 9 inches long, tapering, more developed above than beneath: yellowish-brown in colour, and with closely adherent scales, which have a projecting spine or umbo.

Habitat.—The Shasta Valley and Scott Mountain in California.

Introduced in 1852 by the Scotch Oregon Association, through their collector, John Jeffrey, by whom it was discovered, and after whom it is named.

The above description of the cones is taken from those sent to us many years ago from California, by William Lobb, and preserved in the Museum attached to the Nursery at Chelsea. We have also examined cones produced by some of the oldest specimens of *Pinus Jeffreyi* growing in England, and find that they vary much both in size and shape. We also find variations in the size and shape of the cones of *P. ponderosa* grown in England; forms of the latter closely approaching forms of the former. In their general aspect *P. Jeffreyi* and *P. ponderosa* are scarcely distinguishable, and the leaves of the two are identical in all their essential characters. It has long been suspected that *P. Jeffreyi* is nothing more than a local variety of the widely distributed *P. ponderosa*, and experience of the two in this country tends to point to their specific identity, so that we believe *P. Jeffreyi* must ultimately sink to a synonym of *P. ponderosa*. An examination

of the inflorescence, which we have not yet seen, will doubtless decide the point.

As Jeffrey's name stands prominent among those who have been instrumental in introducing new and fine Conifers into Great Britain, the following particulars of his life and character, from Lawson's *Pinetum Britannicum*, will be read with interest.

"JOHN JEFFREY was a young gardener of Fifeshire, born on the estate of Lochore, the maternal patrimony of the late Sir Walter Scott, and employed in the Edinburgh Botanic Garden, where he attracted the attention of Professor Balfour and Mr. McNab by his zeal and intelligence, and had carried off the prize offered to practical gardeners for the best collection of dried plants made in the neighbourhood of Edinburgh. On the recommendation of Mr. McNab, he was appointed collector for the Oregon Association in the Spring of 1850. He left England in June of that year in one of the Hudson's Bay Company's vessels, bound for York Factory in Hudson's Bay. On his arrival there he accompanied the Company's dispatch brigade, which was then wont every year to cross the continent in winter, and proved that he possessed at least one important requisite of a collector by the readiness which he bore the hazards, the labours, and exposures of the winter journey. He was on his ground in the spring of 1851, and for the whole of that year he devoted himself zealously to exploring and collecting. The first really new introduction of Jeffrey was *Abies magnifica* which he sent home under the name of *A. amabilis*, believing it to be identical with the *A. amabilis* of Douglas. Other fruits of his first year's collection were seeds and cones of *A. Albertiana* and *A. Pattoniana* also new, *A. Douglasii*, *A. Menziesii*, and *Pinus flexilis*, at that time still very rare. In the following year, Jeffrey went further south and sent home seeds of many of the Californian Pines, and among them the species that bears his name. His collections, however, scarcely kept pace with those of his first year; and in the third year, a very marked falling off in the consignments, accompanied by a total cessation of correspondence, led to his engagement being brought to a termination. What became of Jeffrey afterwards is not known. He was last heard of at San Francisco, where, it was said, he had joined an American Expedition to explore the Gela and Colorado. His fate will probably ever remain a mystery."

Pinus macrocarpa.—A large tree, with rounded top and long spreading branches, with the extremities ascending and the young shoots covered with a glaucous violet-brown. The leaves are from 9 to 12 inches long, rather stiff, three-angled and flattened, more or less incurved, and of greyish glaucous green; they are persistent from two to three years, and thus always appear clustered at the extremities

of the branchlets. The cones are larger than those of any other Pine, being from 10 to 12 inches long, with a diameter of about 6 inches at the broadest part, and weighing from 4 to 5 lbs.; the scales are very thick, firmly adherent, of exceedingly hard ligneous texture, armed with a strong hooked spine, smooth, polished, and of a yellowish-brown colour.

Habitat.—California, on the Santa Lucia, at 3,000 to 4,000 feet elevation; also on the coast range as far as latitude 37° N.

Introduced by David Douglas in 1832.

Nothing is known of the economic uses of this tree; the seeds are large, and like those of the closely allied species *Pinus Sabiniana*, edible.

In England its growth is comparatively slow; although it has been introduced nearly half a century, the oldest trees are, with rare exceptions, but of moderate dimensions, and present no special feature of attraction; the foliage is tufted at the extremities of the shoots giving the branches a very naked aspect; but, for the sake of its extraordinary cones, *P. macrocarpa* should be planted in every collection where space can be found for it, and which should have a radius not less than from 25 to 30 feet.

The specific name *macrocarpa* (μακρὸς), "large," and (καρπὸς), "fruit," was appropriately selected by Dr. Lindley, on account of its remarkable cones; it is that by which this Pine is best known in this country; but the name *Coulteri*, given by Professor Don, in compliment to the discoverer, Dr. Coulter, is said to have priority of designation.

Pinus ponderosa.—A large massive tree, varying in dimensions according to situation; on the slopes of the Californian mountains attaining a height of from 150 to 200 feet, with a girth of 18 to 24 feet, but considerably less in the arid plains of Utah and in the higher latitude of Oregon. The bark is a very noticeable and distinctive character; in the mature tree it is yellowish-brown, and divided into large flat smooth plates, from 4 to 8 inches in breadth. The branches are regularly whorled, at first growing horizontally, but becoming decumbent by their own weight. The leaves are confined to the extremities of the branchlets, radiating in all directions, and varying in length from 6 to 12 inches, rather rigid, three-angled, compressed, with roughish edges, and deep glaucous green. The cones are ovoid, from 3 to 6 inches in length, with the scales terminating in a short spine or umbo.

Habitat.—Western America, from British Columbia southwards to the Mexican boundary, and eastwards from the Sierra of California through Nevada, Utah, Colorada, New Mexico, and Arizona.

Introduced by David Douglas, from Oregon, in 1827, and twenty years afterwards by Hartweg, from California, under the name of *Pinus Benthamiana*.

The economic value of *Pinus ponderosa* is very considerable to the inhabitants of the Pacific States of North America. The wood is very resinous, and heavy; it is also brittle, and has the grain much twisted.

Pinus ponderosa is spread over a greater area, and occurs in greater abundance than any other Pine in western America. On the Sierra Nevada, between 4,000 and 6,000 feet elevation, mixed with *P. Lambertiana*, it forms the forest, and on the slopes lower down it is predominant, but intermixed with *Abies grandis*, *Libocedrus decurrens*, *P. Sabiniana*, and other trees. "In the sterile regions of the interior, whole day's marches may be made in forests of *P. ponderosa*, of which the absolute monotony is unbroken, either by other forms of vegetation, or the stillness by the flutter of a bird, or the hum of an insect. In this region it is a noble tree, although never rivalling the gigantic dimensions attained in more favoured localities."*

In a range so extensive, *Pinus ponderosa* is found to show some variation, but no more than might be accounted for by difference of soil and situation. Generally speaking, in the southern portion of its habitat it attains a larger size, and the leaves are somewhat longer and more closely set than those of the more northern trees.

Among the most distinct forms we have met with in cultivation is one in the Pinetum at Highnam Court, near Gloucester, named *Pinus Parryana*, in compliment to the proprietor, Mr. Gambier Parry. It has a more striking aspect than the common form; the branches are more numerous, and better furnished with foliage, and the leaves longer and more pendulous. Another in the collection of Mr. W. Parker Hamond, at Pampesford Hall, near Cambridge, called *P. Sinclairiana* differs from the usual type in having numerous sub-erect branches, clothed at their extremities with thicker and shorter leaves that are quite glaucous.

In England, *Pinus ponderosa* is quite hardy, and its growth moderately rapid, but owing to the limited persistency of the leaves, it has a rather tufted and bare appearance. It is, however, a useful and distinct Pine for the park and landscape.

The specific name *ponderosa*, "heavy," was given by Douglas, on account of its dense heart-wood, which is so heavy as scarcely to float in water. It is called by the settlers "Pitch Pine," from its

* Dr. Newberry, *Pacific Railway Report.*

resemblance to *Pinus rigida* of the eastern States; it is also commonly known in California as "Yellow Pine."

Pinus rigida.—A medium-sized tree, its habit much modified by the influence of soil and climate; on the summits of the Alleghany mountains, it is a mere scrub, in more favourable spots it is upwards of 70 feet high. In England it is generally from 30 to 45 feet high, much branched at the top, forming a dense head; it is also easily distinguished by its very rough dark bark. The leaves are from 3 to 5 inches long, rigid, triquetral, with roughish edges, sharp pointed, and light green. The cones are ovoid, about 3 inches long, with the scales terminating in sharp hooked prickles; they remain on the tree many years.

Habitat.—North America, the eastern States from New England to Georgia, not extending west of the Alleghany Mountain region. Introduced into England about 1759.

The economic value of *Pinus rigida* consists chiefly in its resinous products, which are very abundant, whence this tree has obtained the name of "Pitch Pine," a name also often applied to the southern Red Pine, *P. australis*. The timber is knotty, heavy, hard, and resinous, but of little value. The growth of *P. rigida* in England is rather rapid; it is a sturdy accommodating kind, growing in wet damp places where no other Pine will live; it should be planted for landscape purposes only.

The specific name *rigida*, "stiff," refers to the leaves, but the appropriateness of the designation is not very manifest. There are other Pines that have stiffer leaves than *P. rigida*.

Pinus Sabiniana.—A medium-sized or small tree of spreading straggling habit in its native country, with foliage clustered in double tufts at the extremities of the branches, the young growth of which is covered with a violet glaucous bloom, as in *P. macrocarpa*, but lighter. In England the trunk grows erect and the branches horizontal in direction, but crooked, and always with a bare unfurnished appearance, in consequence of the foliage being persistent but two years. The leaves are from 10 to 12 inches long, rather flaccid, pendulous, slightly twisted, rounded on outer side, with a prominent rib on the inner side, and glaucous bluish-green. The cones are from 7 to 9 inches long, and 5 to 7 inches in diameter, very resinous, and composed of large, hard, strong, scales, terminating in a sharp,

hard, solid point bent like a hook; they are fawn or yellowish-brown, and remain on the tree for several years.

Habitat.—California, from the Santa Lucia to the Oregon boundary. Introduced by David Douglas in 1832.

As a timber tree *Pinus Sabiniana* is not much in repute; the wood is white and tough, but the crooked irregular habit of the tree renders it unprofitable to work.* The large seeds are edible, and were one of the chief resources of the Indians in winter.

Pinus Sabiniana never forms forests, but is disseminated very generally over California; scattered sparsely over rough and rocky surfaces where almost no other plant would take root. It is not found at any considerable elevation.

In England it is tolerably hardy, but somewhat fastidious as to soil and situation. In favourable spots, where it has attained a considerable size; it proves to be a very distinct and by no means inelegant tree, its long pendulous leaves and slender but crooked branches being notable characteristics; but all defects are amply atoned for by its fine cones, which almost rival those of *Pinus macrocarpa* in size and colour. To secure good specimens it should be planted in what gardeners call "warm" land, a good loamy soil with free drainage. A space having a radius of not less than 20 feet should be allowed for it.

Pinus Sabiniana was named by Douglas in compliment to Mr. Sabine, for many years, and at the time of its introduction, Secretary of the Horticultural Society of London.

Pinus tuberculata.—A tree of low or medium height, and sparingly branched. In its young state, it is a handsome ornamental plant on account of its rich deep green foliage; as it grows older the foliage becomes clustered towards the extremities of the branches. It bears cones at a very early age, which are at first produced in clusters on the main stem, afterwards they are produced on the branches also, and as they never fall off, trees of even a moderate age have a very curious appearance. The leaves are from 5 to 6 inches long, triquetral, with scabrous edges, and with an elevated rib running along the middle on the inner side, twisted, and deep green. The cones vary in size (4 to 8 inches long), with the age of the tree, "those on the young trees have the scales on the outer side, particularly towards the base, very prominent, and deeply divided from each other, giving occasion to the specific name *tuberculata*.†

* *Pinetum Britannicum, Pinus Sabiniana.* † *Idem., Pinus tuberculata.*

Habitat.—California, the coast range from Monterey northwards. Introduced into England in 1847 by the Horticultual Society of London, through their collector, Hartweg.

From a paper read before the San Francisco Microscopical Society, by Mr. J. P. Moore, we derive the following interesting particulars respecting *Pinus tuberculata*.

"It cannot be said to be a common tree in the ordinary acceptance of that term. It is mainly confined to the Sierras, and at an elevation of about 3,000 feet. It seems to prefer the southern slopes of the mountains where the soil is very dry, and where it can be fully exposed to the sun. It has the peculiarity of bearing its cones on the main trunk of the tree, giving it a singular appearance as they are arranged around the stem in almost a circle; usually five though often seven cones compose the circle. Sometimes two or three of these circles of cones will be closely crowded together, overlapping each other as they hang down. A peculiar feature of these cones, and one worthy of attention, is their manner of attachment to the trunk. It may be observed that the base of the cones rest against the bark, and that they are so firmly fixed as to bear the pressure of several hundred pounds without breaking off. These cones appear upon the trunk while the tree is quite young, and yet the successive layers of growth rarely ever surround and bury them. The petiole of the cone seems to lengthen, but not quite fast enough to keep pace with the growth of the trunk, so that in many instances it would seem as if the pressure of the subjacent tissue against the base of the cone had forced it out, leaving a hole where the petiole entered the older wood. Nature has also made good provision for the preservation of the seed; the cones are very compact, and covered with a resinous coating which insures them against cracking; they are never shed until the tree dies or has been felled, and even then they do not open for a long time.* In the forests where this Pine abounds, the trees are all of the same age, which may be readily accounted for by the cone shedding. As a timber tree *Pinus tuberculata* has no special value."

This Pine is very distinct and also tolerably hardy, but it should always be planted in a south aspect with full exposure to the sun, and at the same time sheltered from cold winds blowing from the north, north-east, and east.

The following Pines belonging to this section are not sufficiently hardy for the climate of Britain. They are, however, occasionally met with in collections occupying sheltered situations.

* In the Museum of the Royal Exotic Nursery, at Chelsea, are preserved cones of *Pinus tuberculata* that were sent by W. Lobb from California twenty-five years ago. They are at the present time (1881) apparently as firm and compact as when first received.

Pinus australis.—A tall tree with a spreading head and long deep green leaves. Sparingly interspersed with *P. Tæda* it forms the forest extending from Virginia to Florida in the neighbourhood of the Atlantic coast, called the "Pine Barrens." Its timber is fine grained, strong, compact, and very durable; under the name of yellow or brown Pine it is much used in the southern States in constructions of all kinds; under the name of Pitch Pine, large quantities are exported to this country, where it is much used in ecclesiastical edifices. The resinous products of this Pine are collected in great quantities in Carolina and Georgia.

Pinus edulis.—A small tree from 25 to 30 feet in height, with a trunk 8 to 12 inches in diameter. The foliage resembles that of *P. Cembroides;* the cones are short and sub-globose, with thick scales. The seeds are large and edible, furnishing a valuable article of food to the Indians of New Mexico and Arizona, where this Pine is abundant; it also occurs in the neighbourhood of Cañon City, Colorado.

Pinus longifolia.—A tall tree, rather sparingly branched, inhabiting the valleys and lower hills of Nepaul and Bhotan. Its most marked characteristic is seen in the leaves, which are of a vivid green, disposed in spiral rows round the young wood, varying in length from 12 to 18 inches, very slender and pendulous. Next to the Deodar Cedar, it is the most valuable timber tree in the Himalayan region.

Pinus patula.—A beautiful Pine with spreading branches and long pendulous foliage. In its young state it is "as like a green fountain as a green Pine," on account of its bright green, drooping, slender leaves, which quite conceal the stem and branches. It is a native of the colder parts of Mexico, on the Real del Monte, Malpays de la Joya, and other places.

Pinus Tæda, called in America the Loblolly or Frankincense Pine, is a tall tree, from 50 to 80 feet high, with a spreading top, and light green leaves. It occurs in the barren sandy districts in the south-eastern portion of the United States, but nowhere continuously; it is also interspersed with *P. australis* in the "Pine Barrens" near the Atlantic coast. A closely allied form, usually described as a distinct species under the name of *P. serotina*, is sometimes met with in collections. It appears to be somewhat hardier than *P. Tæda.*

Pinus Teocote.—A large tree with spreading and ascending branches, well-furnished with glaucous green foliage. It is a native of Mexico, and found at a considerable elevation on the mountains of Orizaba and Real del Monte, where it attains a height of upwards of 80 feet.

Pinus Torreyana.—A tall Pine sparingly branched and having its foliage tufted at the extremities of the branches. The leaves are from 8 to 10 inches long, stiff, and pungent; the cones resemble and are as large as those of the Stone Pine, *P. pinea*. It is a native of lower California, where it was first discovered by Dr. Parry, and named by him in compliment to Dr. Torrey, the eminent American Botanist; it was subsequently found by Mr. William Lobb, who sent cones and dried specimens to England in 1860, when it was described by Dr. Lindley as a new species under the name of *P. lophosperma*.

Section III.—Pines with Five Leaves in a Sheath.

In this section *Pinus Cembra* and *P. Strobus* may be regarded as the types of the kinds sufficiently hardy for landscape and ornamental planting; the former representing a group of four or five species * in which a pyramidal compact habit, profusion of foliage, and small erect cones bearing wingless seeds, are the most obvious characteristics, while the latter represents several large and tall trees † with spreading branches, long leaves, elongated tapering cones that are quite pendulous when full grown, and bearing winged seeds. Besides these, there are several Mexican species occasionally met with in gardens in the south and west of England which are tender, and rarely arrive at maturity in this country.‡ The timber of the hardy Pines in this section is distinguished by its whiteness, softness, and fineness in grain, that of *P. Strobus* being the most in repute on account of its durability and cheapness; this is the "White Pine" of American commerce. The resinous products are abundant, but are of less commercial importance than those of the Pines in the other sections. The species are very unequally distributed; *P. Cembra* and *P. Strobus* have extensive ranges in the eastern and western continents respectively. *P. excelsa* is confined to the Himalayas, and under the name of *P. Peuce* to the mountains of Roumelia and Macedonia in south-west Europe; there are two species in Japan and northern China, and four in California and the Rocky Mountains; all the others are natives of Mexico, with the exception of *P. occidentalis* (St. Domingo), *P. filifolia*, and *P. tenuifolia* (Guatemala).

* *Pinus Cembra, P. flexilis, P. koraiensis, and P. parviflora.*

† *Pinus excelsa, P. Lambertiana, P. monticola, and P. Strobus.*

‡ They form a separate sub-section, of which *Pinus pseudo-strobus* may be regarded as the type.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PINUS AYACAHUITE (*Ehrenberg*)	*Pinus Loudoniana* (Gordon) ,, *strobiliformis* (Engelmann)	The Hickory Pine	Mexico	75 to 100
BALFOURIANA (*Murray*)	,, *aristata* (Engelmann)	...	California, Nevado Colorado	40— 50
CEMBRA (*Linnæus*)	,, ...	The Swiss Stone Pine	Central Europe and Siberia	50—120
,, pumila (*Endlicher*)	*Pinus Cembra Mandschurica* (Regel)	The Dwarf Cembra Pine	Siberia and Yesso	2— 4
DEVONIANA (*Lindley*)	... ...	The Duke of Devonshire's Pine	Real del Monte, Mexico	60— 80
EXCELSA (*Wallich*)	*Pinus pendula* (Griffith) ,, *Peuce* (Grisebach)	The Himalayan Pine	The Himalayan Mountains	50—100
FLEXILIS (*Torrey*)	,, *cembroides* (Newberry) ,, *albicaulis* (Engelmann)	The Californian Cembra Pine	California ...	5— 50
HARTWEGII (*Lindley*)	... ...	Hartweg's Pine	Orizaba, Mexico	40— 50
KORAIENSIS (*Siebold*)	... ...	The Corean Pine	Corea and Japan	20— 30
LAMBERTIANA (*Douglas*)	... ...	The Sugar Pine	California and Oregon	200—250
LEIOPHYLLA (*Lindley*)	... ...	The smooth-leaved Pine	Mexico	60— 80
MONTEZUMÆ (*Lambert*)	*Pinus macrophylla* (Lindley) ,, *Lindleyana* (Gordon) ,, *Wincesteriana* (Gordon)	Montezuma's Pine	,, ...	60—100
MONTICOLA (*Douglas*)	... ...	...	North California and Oregon	75—100
OOCARPA (*Schrede*)	... ...	...	Mexico	40— 50

Scientific Name.	Synonyms	Popular Name.	Habitat.	Height in Feet.
PINUS PARVIFLÒRA (*Siebold*)	... ...	...	Japan	25— 40
PSEUDO-STRÒBUS (*Lindley*)	... ...	The false Strobus	Real del Monte, Mexico	50— 75
RUSELLIÀNA (*Lindley*)	... ...	The Duke of Bedford's Pine	Mexico	60-- 80
STRÒBUS (*Linnæus*)	... ...	The Weymouth Pine. In America the White Pine	North America, Eastern portion	100—160
,, nàna (*Knight*)	*Pinus Strobus umbraculifera* (Hort.)	The dwarf Weymouth Pine	...	5— 10

Pinus Balfouriana.—An Alpine species, of variable height; in sheltered slopes, it is a tree 40 feet high and of pyramidal outline, but becomes a straggling bush, prostrate, and almost creeping on the bleak summits of the higher ridges of Colorado. The leaves are short, rigid, light green, very glaucous on the inner faces, appressed to the stem and persistent many years, forming tufts of foliage one foot or more long at the ends of the branches. The cones are oval, about 2½ inches long and half as much in diameter, composed of rather hard coriaceous scales, the exposed part with a rhombic protuberance, in the centre of which is a small mucro or hook curved upwards.

Habitat.—North California, on the Shasta and Scott Mountains; on the high mountains extending through Nevada, northern Arizona, Utah, and Colorado.

Introduced in 1852 by John Jeffrey; and, many years afterwards, reintroduced under the name of *Pinus aristata*, which is now regarded as a variety of *P. Balfouriana*.

Pinus Balfouriana is a very slow-growing Pine even on its native mountains, where it may be regarded as the American representative of the European *P. montana*. From the peculiar tufted appearance of the foliage, it has acquired the name of the "Fox-tail Pine" in Nevada.

The specific name *Balfouriana* was given by Mr. Murray, in compliment to the late Professor Botany, in the University of Edinburgh.

The young specimens growing in British gardens under the name of *Pinus aristata*, are somewhat different from those regarded as the true *P. Balfouriana*. They are more robust and of more rapid growth, the leaves are longer, stouter, duller in colour, and much less glaucous on the inner faces. The merits of *P. Balfouriana*, as a decorative tree in this country, have yet to be proved.

Pinus Cembra.—A tall tree of elongated pyramidal outline, and with short crooked branches and deep green foliage. On the slopes of the Alps, it frequently attains a height of 100 feet, but in England it rarely exceeds half that dimension. It is regularly furnished with branches from the base to the summit, and with abundance of foliage, "presenting to the eye a multiplicity of tufts of leaves, piled up one above the other." The leaves are from 3 to 5 inches long, rather rigid, three-angled, with rough edges, and marked with silvery lines. The cones are oval, from 2 to 3 inches long, with smooth scales, terminating in a broad obtuse umbo, each scale enclosing two wingless seeds which are about half an inch long and edible.

Habitat.—Central Europe and northern Asia; on the Alps at elevations between 4,000 and 6,000 feet; on the Carpathian and Ural Mountains, and generally through the forest region of Siberia as far as Kamtchatka, the Kurile Islands, and Jesso.

Introduced into England about 1746.

Pinus Cembra pumila.—A dwarf, stunted bush, from 2 to 4 feet high, often assuming a creeping habit. The leaves are crowded, shorter than those of the species, from 1½ to 2 inches long and very silvery. The cones are small, about 1½ inches long, and 1 inch in diameter. It is a native of eastern Siberia and Jesso.

The economic value of *Pinus Cembra* is very considerable in the alpine regions where it is native; the wood is white, soft, and fine in grain; it has also an agreeable fragrance, which is at the same time obnoxious to insects; it is used chiefly in indoor carpentry, for wainscotting and upholstery, especially for lining clothes chests, &c. The large seeds are much eaten in Russia and Siberia where other fruit is scarce, and in the Tyrol, an oil is expressed from them which is used for lamps.

The chief use of *Pinus Cembra* in this country is for ornamental purposes, for which it is a very distinct tree, whether planted singly or in groups. Its growth is slow, rarely exceeding a foot in one season in the best soils and under the most favourable circumstances, but

generally much less. It requires but little room; it is quite hardy, always well-furnished with foliage, which has a pleasant fragrance during the growing season.

Pinus excelsa.—A handsome tree, with regularly whorled spreading branches, the upper ones ascending, those below more or less decumbent, with the extremities upturned, from which the elegant foliage depends. The bark on the younger growth is pale greyish-brown and quite smooth, but becomes rugged on the older wood. The leaves are from 6 to 8 inches long, slender, flaccid, drooping, three-angled, with rough edges, and glaucous bluish-green. The cones are from 6 to 8 inches long, pendent when mature, slightly curved, and pointed at the apex; the scales large, wedge-shaped, loosely imbricated, the exposed part striated longitudinally and terminating in a small protuberance.

Habitat.—The Himalayas, from Bhotan to Afghanistan, at elevations ranging from 5,000 to 12,000 feet; also the mountains of Roumelia and Macedonia in south-eastern Europe, from 2,400 to 5,800 feet elevation.

Introduced into England by Dr. Wallich about 1827.

As an ornamental Pine, *Pinus excelsa* takes a high rank among landscape and park trees; it thrives best in light and well-drained soils on sloping ground; on heavy clay and chalk land its growth is much slower and its general aspect much less striking. The best specimens of *P. excelsa* in this country, cover a space having a radius of upwards of 25 feet.

The *Pinus excelsa* found in south-eastern Europe and described as a distinct species by the late Professor Grisebach under the name of *P. Peuce*, is a smaller tree than the Himalayan form. In England the young plants are denser in habit, more conical in outline, and have shorter and stiffer leaves.

The specific name *excelsa*, "lofty," refers, according to Major Madden, not to the stature of the tree, but to the elevation at which it is found.

Pinus flexilis "is an Alpine species growing high up the Rocky Mountains and Sierra Nevada, looking like a dark and gloomy Scotch Fir, but not so blue in its black, although, perhaps, even deeper in its colouring, and characterised by fine gnarled and twisted limbs."* It varies much in height, from a low scrubby bush to a tree 50 to 60 feet high, and from 2½ to 4 feet in diameter.

* Mr. A. Murray, in *Gardeners' Chronicle*, 1875, IV., p. 356.

The leaves are from 2 to 2½ inches long, three-angled, rigid, erect and glaucous green; the cones resemble in size and shape those of *P. Cembra*, to which this Pine is closely allied.

Habitat.—The mountain ranges of British Columbia, California, and Nevada, from 7,000 to 10,000 feet elevation; also on the Rocky Mountains, from Montana to New Mexico.

Introduced by John Jeffrey, in 1851, but discovered some years previous by Nuttall.

"On the summit of the Cascade Mountains in California, the bleak and barren surfaces are held by this Pine in a possession undisputed by any other tree. It is there, by the rigour of the climate, compelled to grow in thick and tangled masses scarcely rising above the surface. Lower down it attains much greater dimensions. On the Monitor Range, in central Nevada, trees from 50 to 60 feet high are not infrequent, the finest specimens being found on the banks of the mountain streams. *Pinus flexilis* is known among the colonists as "White Pine," and is the only tree of the region sawn into lumber. The wood is soft, white, and, although not free from knots, is of fair quality, being about intermediate between eastern White Pine (*P. Strobus*) and Sugar Pine (*P. Lambertiana*)." *

The specific name *flexilis* refers to the pliant crooked branches.

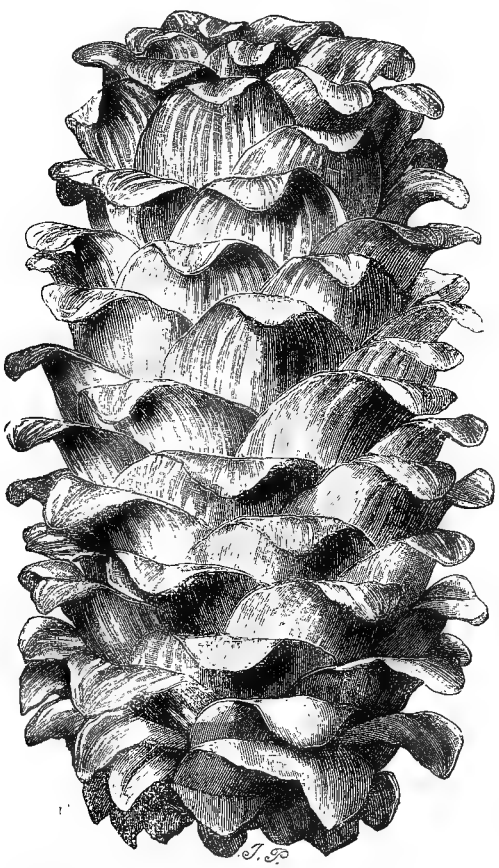


Fig. 40.—Cone of *Pinus koraiensis*. Natural size.

Pinus koraiensis is believed to have been introduced many years ago from the Corea into Japan, being

* Professor Sargent in *American Journal of Science and Art*, June, 1879.

met with only in cultivation in the last-named country. The adult trees, which are few in number and chiefly found in proximity to temples, range from 20 to 30 feet high. The trunks are straight to about 12 or 15 feet, when they divide into three or more ascending branches, each with numerous much ramified secondaries, giving the trees a densely rounded head, a form they have doubtless been made to assume at the hands of the Japanese. The leaves are slender, trigonal, with the edges roughish, 3 to 4 inches long, bright glossy green on the outer and broader side, and silvery on the two inner or narrower sides. The cones are almost cylindrical, very obtuse both at base and apex, about 5 inches long and 3 in diameter; the scales are hard and leathery, with the points turned back.

Habitat.—Corea and Mantchouria, as far as the Amour River.

Introduced in 1861 by Mr. J. G. Veitch.

Pinus koraiensis is one of the most useful of Pines for garden decoration; its comparatively small size, compact habit, and elegant foliage render it available and even desirable for planting where the fast-growing larger Pines would be inappropriate.

Pinus Lambertiana.—A lofty tree, the tallest of all Pines, attaining a height of from 200 to 250 feet, with a circumference near the ground of from 20 to 30 feet. Its massive perpendicular trunk is generally free of branches to two-thirds of its height, above which the tree has an open pyramidal head like that of an Abies, the branches being pendulous.* The bark is rather smooth, ash-grey, and full of resin; the leaves are clustered towards the extremities of the branches; they are from 3 to 5 inches long, three-angled, with the edges rough, slightly twisted and of a bluish glaucous green. The cones are from 15 to 20 inches long, with a diameter of from 3 to 4 inches, cylindrical, tapering at the apex; the scales are large, loosely imbricated, and enclosing two large edible seeds of a nutty flavour.

Habitat.—California and Oregon, from the Mexican line to the Columbia River.

Introduced in 1827 by David Douglas.

Pinus Lambertiana does not form forests but is always associated with other trees, as the Redwood and *P. Ponderosa*. In the vicinity of

* *Pinetum Britannicum. Pinus Lambertiana.*

Crescent City these trees combine to form one of the most magnificent forests in the world; the Redwood and the Sugar Pine *(P. Lambertiana)* attaining nearly equal gigantic dimensions. North of 42° N. it mixes with *Abies grandis*, *A. Menziesii*, *Thuia gigantea*, and other trees forming the dense vegetation of the region; and in the transverse chains that cross the country from the coast to the Shasta Mountains and Mount Pitt, it has for its companions *P. ponderosa*, *P. contorta*, and *Abies grandis*, which far surpass it in numbers as it, in its turn, exceeds its fellows in dimensions.* The timber is white, soft, homogenous, and usually straight grained, but heavier and stronger than that of the eastern White Pine (*P. Strobus*). The seeds have a sweet taste, which gave occasion to the early settlers in the country to call this tree the "Sugar Pine."

In England *Pinus Lambertiana* thus far shows no indication of rivalling the gigantic dimensions of its parent in California. Although introduced fifty years ago, there are few specimens that exceed a height of 50 feet; its growth in all soils and situations is very slow, especially during the first years from the seed. It is, however, a handsome tree of erect habit, with branches short and slender in proportion to the height of the trunk, the lower ones spreading, those higher up with the ends inclined upwards, and the highest ones ascending and generally well furnished with foliage distinguished by its bluish-green tint. To ensure a good specimen of this noble tree it should be planted in a situation sheltered from winds blowing from the north, north-east, and east, and a clear space having a radius of not less than from 20 to 25 feet should be allowed for it.

The specific name was given by Douglas, in compliment to A. B. Lambert, Esq., a munificent patron of science, and the author of a beautifully illustrated large folio work entitled *The Genus Pinus*. This work, together with the encouragement he gave to the discovery and introduction of new kinds, has associated Mr. Lambert's name with Coniferous plants.

Aylmer Bourke Lambert was born at Bath in February, 1761, and died at Kew in January, 1842. He was educated at St. Mary's Hall, Oxford, and early devoted his attention to botany. He was one of the founders of the Linnæan Society, of which he was one of the Vice-Presidents; he was also a Fellow of the Royal Society. When he came to his paternal estate, he formed a large herbarium, which was for many years under the charge of Mr. Don. This collection, as well as Mr. Lambert's extensive library, was made available to all men of science. There was an open reception of scientific men every Saturday at Mr. Lambert's house. He was anxious to encourage science, and his ample means enabled him to gratify his taste in this

* Dr. Newberry, *Pacific Railway Report*, p. 11. Lawson's *Pinetum Britannicum—Pinus Lambertiana*.

respect. For many years his health was feeble, and he retired to Kew, where his proximity to the Royal Gardens afforded the means of gratifying his botanical tastes. Besides the work above mentioned, he published a description of the genus Cinchona, and contributed many papers to the *Transactions of the Linnæan Society*. After his death his herbarium was sold by public auction, when a small portion of it was purchased for the British Museum.*

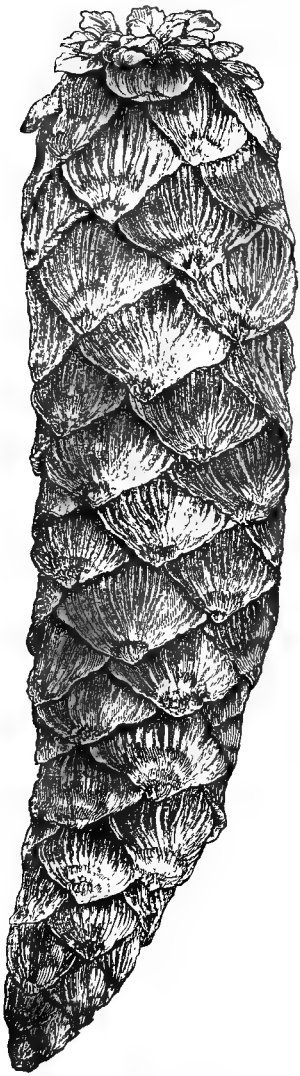


Fig 11 - Cone of *Pinus monticola*. Natural size.

Pinus monticola.—A handsome tree of pyramidal habit; the trunk is erect, and furnished with whorls of branches that are rather short in proportion to the height of the tree; the bark is smooth and greyish ash-brown. It is a Strobus Pine, having shorter and more rigid foliage than that of the type; the leaves are about 3 inches long, three-angled, with the edges slightly scabrous, the sheaths short and the points blunt; the outer or rounded side is dark glossy green, the flattened or inner sides are whitish or glaucescent. The cones are from 5 to 6 inches long, tapering to a sharp point, and generally a little curved towards the apex.

Habitat.—California, Oregon, and Washington territory; on Trinity Mountain, near the Rapids of the Columbia, and on the rocky banks of the Spokane River.

Introduced by David Douglas in 1831.

Pinus monticola is quite hardy, and is a beautiful Pine for the lawn and park. In selecting a situation for it, preference should be given to a south-east or south-west aspect, and a clear space, with a radius of not less than 18 feet should be allowed for it.

The specific name *monticola*, "dwelling on the mountain," refers to the elevated spot in which Douglas first found it. It was, however, subsequently found in

* Chiefly from the *Imperial Dictionary of Universal Biography*.

the plains, and on the banks of the rivers, in Oregon and Washington territory. The wood of *Pinus monticola* is white, fine grained, strong, and durable.*

Pinus parviflora.—A medium-sized or low tree, of compact habit, with a bluntly pyramidal head, and clothed with dense short foliage. The branches are approximate, either horizontal or slightly ascending at the extremities, and furnished with numerous short, tufted branchlets. The leaves are from 1 to 1½ inch long, crowded, rigid, slightly twisted, light green on the outer or rounded side, and quite glaucous or silvery on the inner or flattened sides. The cones are ovate-elliptic, from 2½ to 3½ inches long, composed of about twenty coriaceous broadly wedge-shaped scales.

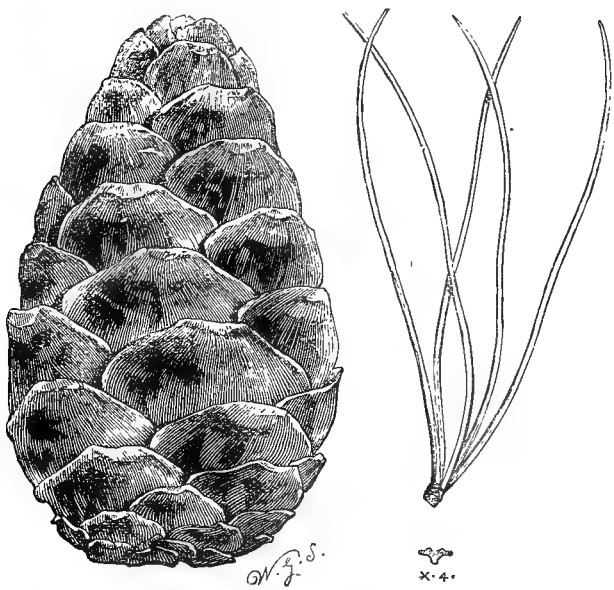


Fig. 42.—Cone and leaves of *Pinus parviflora*. (From the *Gardeners' Chronicle*.)

Habitat.—Japan.

Introduced in 1861 by Mr. J. G. Veitch.

Pinus parviflora, according to Siebold, although found cultivated all over Japan, is a native exclusively of the northern islands, extending from about latitude 35° N. to the Kurilo islands. The above description applies only to the cultivated *P. parviflora*, and, from which, all the older plants in British gardens are derived. In its wild state, in the island of Jesso, it attains a larger size than the cultivated form; the leaves are also longer, and of a deeper green; the cones too, are longer, with the scales less crumpled at their edges.

Pinus parviflora is one of the most distinct of the Cembra Pines, and owing to its small size, well-furnished trunk, and dense foliage, which is persistent three years, it is one of the best of the tribe that can be selected for the lawn and shrubbery; it prefers a moist loamy

* *Gardeners' Chronicle*, 1878, ix., p. 52.

soil. It is more esteemed by the Japanese gardeners than any other Pine; they cultivate it assiduously, dwarfing it to the smallest possible dimensions, or training it into all kinds of fanciful shapes.

The specific name *parviflora*, refers to the small size of the male catkins, which are very numerous, and thickly crowded into a cylindrical spike, 1 to 2 inches long.

Pinus Strobus.—A tall tree, rising in a straight column, from 120 to 160 feet high in cool and damp woods in its native country, generally divested of branches for the greater part of its height, and with a conical top. In England the habit of *P. Strobus* varies according to the soil in which it is growing; in loamy and heavy land the branches are spreading and usually well furnished with foliage; in dry sandy land, and in exposed places, the branches are short and the foliage tufted at their extremities. In the young state the bark is greyish-brown and quite smooth; in old trees it is rugged on the trunk and principal branches. The leaves are from 3 to 5 inches long, slender, soft, light green, marked with silvery lines, spreading in summer but contracted or pendulous in winter.* The cones are from 6 to 8 inches long, cylindrical, tapering, and slightly curved; the scales are smooth, thickened at the apex, and during the growing season covered with white resin.

Habitat.—North America, the eastern portion of the continent from latitude 50° N., southwards to the Alleghanies as far as Georgia, and from the Atlantic to the Mississippi.

Introduced into England in 1705.

Pinus Strobus nana is a small, compact, bushy shrub, with short slender branches and numerous branchlets. The leaves are shorter than those of the species, and densely clustered at the extremities of the branchlets.

Other varieties named respectively—*aurea, compacta, nivea, variegata,* and *viridis,* have been in cultivation, but are now rarely met with.

Pinus Strobus is one of the most important of the American timber trees, and great numbers are felled every year, and sent to Europe, under the name of White Pine. It is very abundant in the New England States. "It is also common all over Canada, and is one of the most valuable of the timber trees of that country, being durable,

* This peculiarity has been observed in other Pines of the Strobus section; in *Pinus excelsa, P. Lambertiana, P. monticola,* &c.

free from knots, and very easily worked. It finds its way into every carpentering establishment in Great Britain."*

In England, the principal, if not the only use of *Pinus Strobus* in planting, is for the park and landscape, and for mixing with other trees in forming belts, screens, &c. Experience has shown, that although it will grow in all ordinary soils, its rate of growth, which averages about 12 or 13 feet in ten years, is not only much slower than that of several of the two-leaved Pines, but also the timber of home-grown trees is less valuable, which is doubtless owing to climatal causes.

The specific name *Strobus*, appears to have been taken by Linnæus, from Pliny,† who mentions a tree called Strobus, indigenous to Carmania, a province of ancient Persia, where it was sought after for fumigating or incense. It is not known what tree this was. *P. Strobus* is called the Weymouth Pine, from having been extensively planted by Lord Weymouth, at Longleat, in Wiltshire, soon after its introduction, and whence seeds were afterwards distributed.

The following Pines, all natives of the higher mountain regions of Mexico, were introduced to British Gardens by the Horticultural Society of London, through their collector, Hartweg, who discovered them in 1838-9:—

Pinus Ayacahuite.—A large tree, attaining a height of 100 feet. It has whorled spreading branches, and long lax, slender, glaucous leaves, and much resembles *P. Strobus* in habit and appearance. It is a native of the mountains in northern Mexico, where it occurs at elevations between 7,000 and 11,000 feet. It rarely escapes injury during severe weather in England, even in sheltered situations.

Pinus Devoniana.—A fine tree, 60 to 70 feet high with spreading branches and deep green leaves, 8 to 10 inches long, with sheaths 1 inch long. It was discovered by Hartweg, on the mountains in the neighbourhood of Oaxaca, at an elevation of 8,000 feet, and named by Dr. Lindley in compliment to the Duke of Devonshire. It closely resembles *P. Montezumæ*, of which it is probably only a variety. It is rather tender.

Pinus Hartwegii.—A medium-sized tree, with thick crooked branches and light green leaves. It is found on the mountains in the neighbourhood of Oaxaca, where it was discovered by Hartweg in 1839. It was named by Dr. Lindley after its discoverer. It is somewhat hardier than most of the Mexican Pines, but liable to injury in severe weather.

* Mr. Rowan's *Emigrant and Sportsman in Canada.*

† Petunt et in Carmanos arborem strobum ad suffitus perfusam vinco palmes accendentes, xii., c. 17.

Pinus leiophylla.—A tall tree with a pyramidal head, horizontal branches, subpendulous at the extremities, and long, slender, drooping foliage. It is a native of the mountains between Cruz Blanca and Jalacingo, and some other places in Mexico. It is quite tender in England.

Pinus Montezumæ.—A large tree "attaining a height of from 45 to 60 feet, with large irregular branches, thickened branchlets, and leaves 10 inches long, but shorter in old trees."* It is one of the commonest of the Mexican Pines, and was discovered early in the present century, but not introduced into England till Hartweg sent home cones and seeds in 1839. It is not hardy.†

Pinus oocarpa.—A medium-sized tree with an open head, the lower branches decumbent, rather rigid leaves, and small egg-shaped cones, whence the specific name. It was found by Schiede between Ario and Monte Jorullo, and afterwards by Hartweg, who sent seeds for the first time to Europe in 1838. It is not hardy.

Pinus pseudo-strobus.—A large tree with spreading branches, much resembling the Himalayan Pine (*P. excelsa*), but having lighter green and more glaucous foliage. It is a native of the mountains of Aguanguco and Orizaba, and other parts of Mexico. It is quite tender.

Pinus Russelliana.‡—One of the handsomest of the Mexican Pines. It has robust spreading branches, with the foliage tufted at their extremities; the leaves are a foot long, bright green, and gracefully pendulous. It is found on the Real del Monte, in Mexico, where it was discovered by Hartweg, and named by Dr. Lindley in compliment to the Duke of Bedford. It is not hardy.

The introduction of the Mexican Pines described above, and others from California, has placed Hartweg's name among the most prominent of those who have enriched the gardens of Europe with fine Conifers. The following is a short sketch of his life:—

KARL THEODER HARTWEG was born in 1812, at Carlsruhe, in the Grand Duchy of Baden, and descended from a long line of gardeners. Besides the advantages of his father's experience, he enjoyed the

* Carrière, *Traité Général des Conifères*, p. 415.

† According to Parlatore, *Pinus Lindleyana* and *P. macrophylla* are but varieties of *P. Montezumæ*, the former having shorter and the latter longer leaves.—*Prod.* xvi., p. 399.

‡ Parlatore gives *Pinus Russelliana* as a synonym of *P. Montezumæ*. The specimen of the former at Bicton, doubtless the finest in England, is quite distinct from that Pine.

benefits of a far better education than usually falls to the lot of a gardener. Unfortunately, his father died before Karl had completed his nineteenth year, and, consequently, he determined to visit France and England, where the state of Horticulture was in advance of that of Germany.

He first went to Paris, and succeeded in obtaining a situation in the Jardin des Plantes, and whilst there, he laboured most assiduously to make the most of the opportunities offered by that establishment to improve himself. After gaining a tolerable knowledge of French, he came to England haphazard, but falling ill before he obtained any employment, he became very needy. When his health became better, he entered the Horticultural Society's garden as a common labourer, where his superior intelligence and education soon became evident to the authorities, and he was advanced to the higher and more lucrative post of garden clerk. About that time, the lamented Douglas met with his death, and it was resolved by the Society to send another person to explore the highlands of Mexico, chiefly with a view to the possible discovery of new plants which would bear the climate of this country.

Hartweg, having been selected for the expedition, left England in October, 1836, for Vera Cruz, and from thence went to Santa Fé. He did not, however, remain long in the unhealthy lowlands, but ascended the Taquapan on the east side of the lofty Orizaba; and here he met with the first batch of the many splendid epiphytal Orchids with which he enriched our gardens. He afterwards went to the Aguas Calientes and Bolanos. Having explored the district, he proceeded, in February, 1838, to Mechoancanha, where he made his first important discovery of Coniferous trees, for here he found *Pinus oocarpa*, *P. leiophylla*, and *P. pseudo-strobus*. Here, too, he saw the majestic sacred fir *Abies religiosa*, rising to a height of 150 feet. His next move was to the Real del Monte, and thence to Queretaro, where he met with *Pinus Cembroides (Llaveana)* and *P. patula*, in company with *Cupressus thurifera*, better known in England by the name of *C. Knightiana*.

At the close of 1839, Hartweg was instructed to go to Guatemala, and on his way he visited Oaxaca, the seat of Cochineal culture. He remained a few days and discovered *Pinus Russelliana*, *P. Devoniana* and *P. Teocote*. While staying at Quesaltenango to collect Orchids, ascending the highest of the mountain range, he discovered *P. Hartwegii* and *P. filifolia*. He afterwards made a trip to Ecuador, and the Cordilleras of New Granada, where he found several Orchids not previously known. Soon after he embarked for England, where he safely arrived in 1843, after five years absence.

In 1845 Hartweg went out again to America; this time to California. In his excursions through the country, he discovered *Pinus*

tuberculata, *P. muricata*, and *Cupressus Goveniana*, and by collecting cones and seeds of species previously discovered by Douglas, he was the means of greatly increasing the number of living plants in England of these grand specimens of arborescent vegetation. In addition, he sent home a large number of hardy annuals and herbaceous plants. Altogether Hartweg was absent on his different exploring travels about nine years and a-half. He did not remain long in England after his return, but went back to his native country. The late Grand Duke Leopold having taken great interest in him, appointed him inspector of the Ducal Gardens at Schwetzingen, which post he held till his death in February, 1871.—(Abridged from the *Wochenschrift* and *Gardeners' Chronicle*, 1871).

V.—ARAUCARIA *(Jussieu)*.

The Araucarias are lofty evergreen trees, natives of the southern Hemisphere, where they may be regarded as partly representing the Firs and Pines of the north. Their most obvious characteristics are—

The trunks are perfectly straight and erect; the branches are in whorls, of from four to eight, five being the prevailing number, usually horizontal, but the lower ones decumbent, and those above ascending.

The leaves are spirally arranged around the branches,* imbricated in nearly all the species, and persistent many years; they are either comparatively broad, flat, ovato-lanceolate, and very sharply pointed, or narrow, four-angled, and compressed, and often curved.

The species having broad, sharp-pointed, coriaceous leaves, have also large ovate cones with wingless scales;† those having narrow, tetragonal, and compressed leaves, have also smaller spherical cones with winged scales;‡ there is also a difference in the mode of germination of the seeds of the broad and narrow-leaved species. The Araucarias, therefore, admit of a division into two tolerably well defined groups: the first (Colymbea), comprising *Araucaria imbricata*, *A. brasiliensis*, *A. Bidwilli*, and *A. Rulei;* and the second (Eutacta), including *Araucaria excelsa*, *A. Cunninghami*, and *A. Cookii*.

* *Araucaria Bidwilli* is an exception.

† Strobili squamæ apteræ, Parlatore.—*Prod.* xvi., p. 370.

‡ Strobili squamæ alatæ.—*Idem.* p. 372.

So far as yet observed, the Araucarias are considered to be dicœcious plants, that is to say, the pollen bearing and ovule bearing catkins are produced on different trees, and not on the same tree, as in the Firs and Pines. The fertile cones are solitary and erect, and each scale produces but one seed.

The Araucarias are not absolutely dicœcious, probably far from it. There is a tree of *Araucaria imbricata* at Bicton, in Devonshire, that has borne catkins of both kinds for several years past, and many young plants have been raised from the seeds of its fertile cones. By the kindness of the Right Hon. Lady Rolle we are enabled to give an illustration of this tree, and also of a fertile branch taken from it. A fine tree at South Lytchelt, in Dorsetshire, has shown the same peculiarity. As the numerous healthy trees now growing all over Great Britain become cone bearing, the monœcious principle may probably be found among them to an extent not hitherto suspected. The difference in the sex of the trees was generally thought to give rise to the difference in aspect and habit that occurs so frequently among plants of the same species. The Araucarias, like other Coniferæ, are now known to be polymorphous, irrespective of sex, which is shown by the numerous varieties and sub-varieties of nearly all the kinds under cultivation, that are constantly making their appearance.

The economic value of the Araucarias has not yet been much developed. The timber of *Araucaria imbricata* is used in southern Chili; the heart wood is yellowish, that more recently formed white, it is very fibrous, beautifully veined, and admits of a fine polish.* The timber of the Moreton Bay Pine is fine, close grained, and durable. The secretions are employed for various purposes in the countries in which the trees are natives; the fragrant resin that exudes from the trunk of *A. brasiliensis* is mixed with wax for making candles. The whitish resin of *A. imbricata* is used by the Chilians, when fresh, as a remedy for bruises, wounds, &c., and when dried, it is employed in many ways as a mitigant of pain.† The seeds or "nuts" of all the large coned species are edible, and are consumed in great quantities by the inhabitants of the provinces and districts where these trees abound.

The Araucarias are natives of a comparatively restricted area in South America, eastern Australia, and some of the adjacent islands.

* Su madera, de un blanco, medio anarillento, es llena de fibras y de vetas muy vistosas y admite un buen pulimento. *Historia de Chile*, por Claudio Gay.—*Tomo* v., p. 416.

† *Idem.* loc. cit.

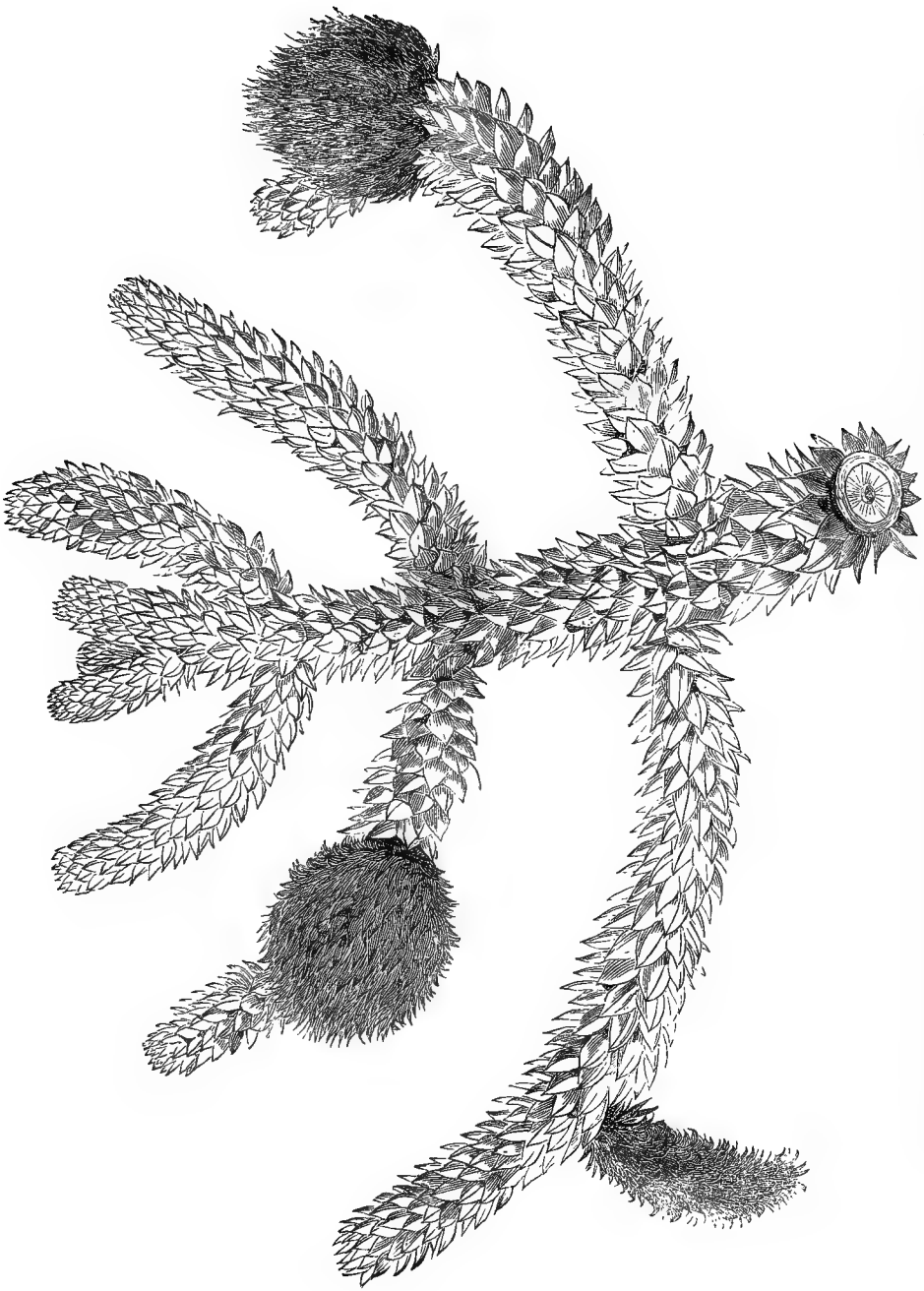


Fig. 43.—Branch of *Araucaria imbricata* with both pollen and ovule-bearing catkins. From the monœcious tree at Bicton, Devonshire.

The South American species have the widest range, and form extensive forests in southern Brazil and Chili; the Australian species have a more limited range, some of them, so far as at present known, being confined to a single island.

Only one species is sufficiently hardy for the climate of England, but nearly all the other kinds are cultivated in their young state for the decoration of conservatories, &c. Their formal but pleasing habit, and bright green foliage, render them very picturesque, and suitable subjects for these structures.

Araucaria is derived from Arauco, the name of a province in southern Chili, where the earliest discovered species *(Araucaria imbricata)* is abundant.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ARAUCARIA IMBRICÀTA (*Ruiz & Pavon*)	*Araucaria Dombeyi* (Richard) ,, *chilensis* (Mirbel) *Dombeya chilensis* (Lamark) *Pinus Araucaria* (Molina) *Colymbea quadrifaria* (Salisbury) ,, *imbricata* (Carrière)	The Chili Pine	Chili	100 to 150

The following species and varieties are not hardy in Great Britain.

ARAUCARIA BIDWÌLLI (*Hooker*)	*Colymbea Bidwilli* (Carrière)	Bidwill's Araucaria or the Bunya-Bunya	Queensland, Australia	100 to 150
BRASILIÈNSIS (*Richard*)	*Pinus dioica* (Arrabida) *Colymbea brasiliensis* (Carrière)	The Brazilian Araucaria	Brazil, Prov. of São Paolo and Minas Geras	75—100
COOKII (*Brown*)	*Araucaria columnaris* (Hooker) *Eutacta Cookii* (Carrière)	Captain Cook's Araucaria	New Caledonia & New Hebrides	100—120
CUNNINGHÀMI (*Aiton*)	,, *Cunninghami* (Link)	Cunningham's Araucaria, or Moreton Bay Pine	Queensland, Australia	100—125
,, glauca (*Hort.*)	,, *Cunninghami glauca* (Carrière)	...	Garden variety...	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ARAUCARIA EXCÈLSA (*Brown*)	*Dombeya excelsa* (Lambert) *Eutacta excelsa* (Link)	The Norfolk Island Pine	Norfolk Island	100—150
,, glaùca (*Hort.*)	,, *excelsa glauca* (Carrière)	...	Garden variety...	
,, robusta (*Hort.*)	... ...	...	,, ,,	
RÙLEI (*Mueller*) ,, elegans (*Hort.*)	*Eutacta Rulei* (Carrière)	Rule's Araucaria	New Caledonia	40— 50

Araucaria imbricata.—A tall tree of singular habit and striking aspect, caused by the formal arrangement of the branches in regular tiers or whorls, generally of fives, growing horizontally from its straight upright trunk, and by its rigid, sharp-pointed, "noli-me-tangere" foliage, uniformly covering the branches and their ramifications, and even the trunk itself, during many years of its growth. Although the direction of the branches is at first horizontal, the lower ones in time become sub-pendulous or decumbent by their own weight; those forming the uppermost tiers curve upwards, giving the top of the tree a candelabra-like appearance. The branchlets are in opposite pairs, distichous, or whorled, like their primaries. The leaves are ovate-lanceolate, without foot-stalks, thickened at the base, very stiff, leathery, and sharply pointed, about an inch long and half an inch wide at the broadest part, and of a bright green on both sides. Both pollen and ovule-bearing catkins are produced at the extremities of the upper branches, the former soon withering, and falling off after the pollen is shed, the latter continuing to increase in size until it attains its maturity, which it does in the autumn of the second year, so that the branch on which it is produced has increased in length by two season's growth when the seed is ripe. The fertile cone is nearly spherical, from 6 to 8 inches in diameter; it soon falls to pieces after arriving at maturity; the scales and seeds coalesce, and form

wedge-shaped bodies more than an inch long, terminated at top in a curved bract-like appendage.

Habitat.—Chili, on the western slopes of the Andes, from about latitude 36° S. southwards to about latitude 45° S.

Introduced into England in 1796, by Archibald Menzies, but first discovered about twenty years previous by an officer of the Spanish Navy.

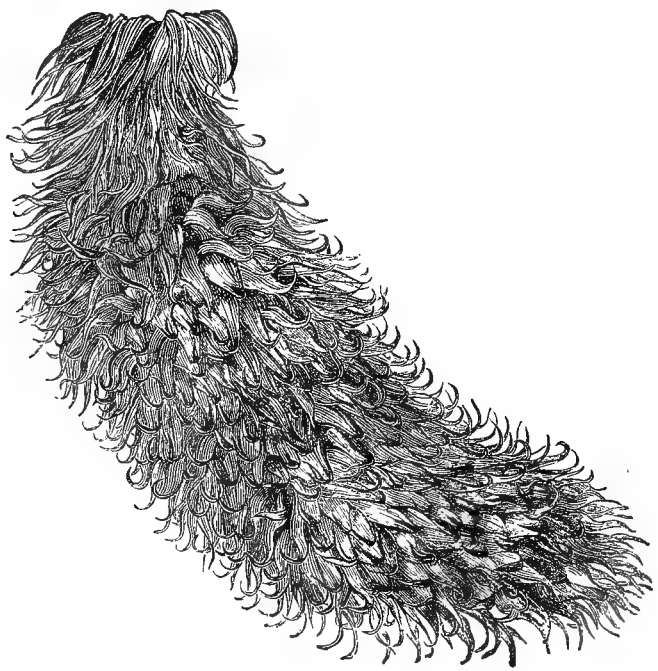


Fig. 44.—Pollen-bearing catkin of *Araucaria imbricata*. Natural size.

The preceding description applies to the Araucaria as usually seen in the parks and gardens of Great Britian. In its native forests, where the trees are frequently much crowded, the lower branches are cast off like those of the Firs and Pines when growing close together, and merely crowns of foliage are left at the tops of the trunks, and these rarely occupying more than the upper third or fourth of their height. The strangeness of the aspect of these trees is increased by the large hedgehog-like globular cones placed at the extremities of the branches. Like the Firs and Pines, their roots spread near and at the surface of the ground, and on the declivities of the mountains, creep over the bare rocks and barren slopes like gigantic serpents.

Beyond the brief outline sketched above, the limits of the geographical range of *Araucaria imbricata* are but imperfectly known. According to Professor Poeppig, it is found in the northernmost portion of its habitat, only on the higher slopes of the Andes, and always in proximity to the snow line, forming a belt of forest of from 1,500 to 2,000 feet of elevation immediately below it. Further south it descends to a lower elevation, the area over which it is spread gradually widening till it approaches the ocean at its southern limit.

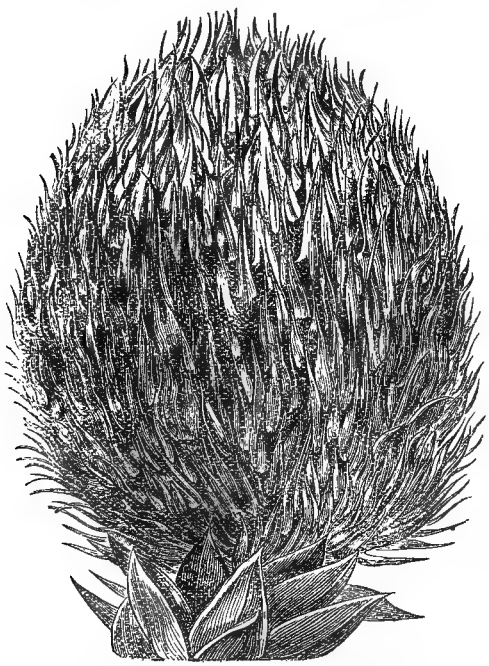


Fig. 45.—Ovule-bearing catkin of *Araucaria imbricata*. Natural size.

Araucaria imbricata was discovered in 1780, by Don Francisco Dendariarena, a Spaniard who was at that time officially employed to ascertain if any timber suitable for ship-building was procurable in southern Chili.* It was also found very shortly afterwards by Drs. Ruiz and Pavon, two Spanish botanists, who went out to Peru in 1777, to investigate the forests of that country, with the special object of collecting information respecting the Cinchona or Peruvian Bark, and who subsequently extended their explorations further south. They were accompanied by a French gentleman, named Dombey, but he returned to Europe after a short stay, and before Ruiz and Pavon sailed for Chili. It was to him that Ruiz and Pavon sent the first dried specimens of the Araucaria received in Europe, and by him these were submitted to the eminent botanist Lamark, who named the tree *Dombeya chilensis*, and thus Dombey's name become associated with the synonymy of the tree. In 1795, Captain Vancouver reached the coast of Chili, when Mr. Archibald Menzies, who accompanied him in the capacity of botanist, procured some cones and seeds, and also some young plants, which he succeeded in bringing home alive. He presented these to Sir Joseph Banks, who planted one in his own garden, and sent the others to the Royal Gardens, at Kew. One of the Kew plants still survives, and it is therefore the oldest, although not the largest Araucaria in Great Britain. For many years the Araucaria continued

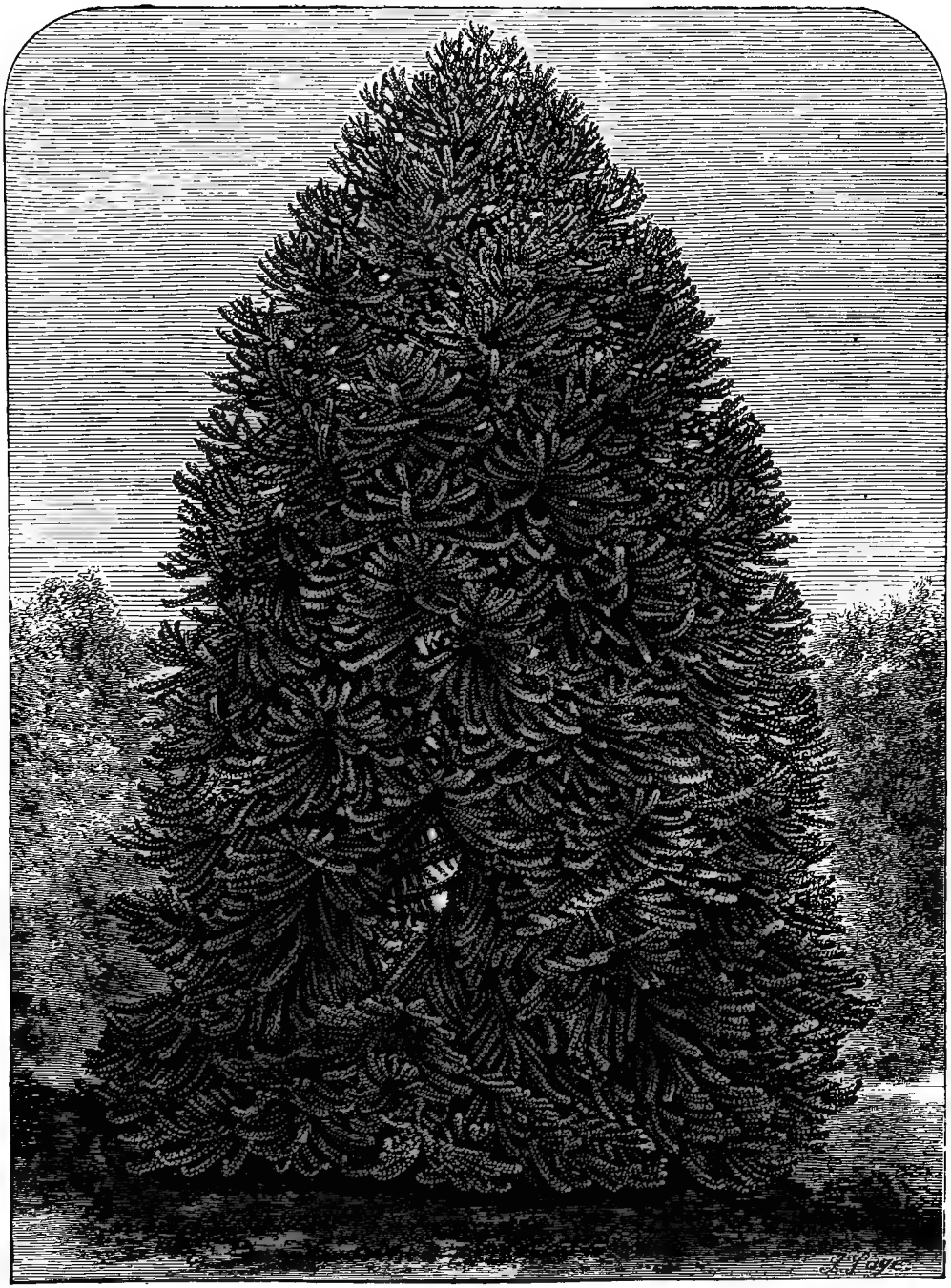
* Loudon, *Arb. et Frut.*, p. 2436.

to be very scarce in England; seed could not be obtained, and the small quantity that reached this country from time to time, failed to germinate. It was not till 1844 that Mr. William Lobb, while collecting in South America for our Exeter firm, succeeded in penetrating the Araucaria forests, and thence brought home the first large supply of seed received in England, and, from which, very many of the fine specimens now growing in various parts of the country originated.

It is worthy of note that *Araucaria imbricata* is the only Conifer yet introduced from the southern Hemisphere that has attained a timber-like size in England.* Its powers of endurance were severely tested in the memorable winter of 1860-1, when many fine trees were killed, but the casualties occurred under such a variety of circumstances, that it is difficult, if not impossible, to deduce any special law affecting the hardiness of the tree. The following conditions are essential to securing fine free growing specimens:—The soil must have a thorough drainage, either natural or artificial, to prevent the stagnation of water at the roots; the trees should be planted in full exposure to sun and air, and if in an elevated situation, so much the better, a free open space being more conducive to their progress and well being, than a confined and sheltered one. In very dry soils, the Araucaria lives, but it loses its lower branches at an early age; the branches are slender, and frequently become flaccid, and the plant has a thin starved appearance; it also loses its lower branches early when in a confined space, or in contact with other trees or shrubs, or when its roots penetrate into an ungenial sub-soil; it languishes if within the influence of the smoke of towns; and the foliage takes a yellowish sickly tint, if the roots enter and remain in stagnant water, or water logged soil for a lengthened period. On the western slopes of the Chilian Andes, the native home of the Araucaria, the rainfall is far more copious than in England, and the trees are also within the influence of the southern region of prevalent westerly winds blowing across the Pacific Ocean. Hence it is, that in Great Britain they thrive best where the rainfall is greatest, and the soil porous enough to carry off the water freely.

The aspect of *Araucaria imbricata* is dark and massive, and large healthy specimens furnished with tiers of branches from the ground to the summit are even grand and strangely impressive. Whether solitary, or planted in avenues, it is the most effective of all Conifers for contrast. The ARAUCARIA AVENUE at Bicton, belonging to the Right Hon. Lady Rolle, presents one of the most striking and remarkable arboricultural effects that can be seen in this country. Isolated specimens, imposing as they are, convey but a faint conception of the magnificent vista produced by a double row of these strangely wonderful

* One or two Dacrydiums, natives of Tasmania and New Zealand, that have attained some height in particularly favoured spots, can scarcely be called exceptions.



Araucaria imbricata at Dropmore. Present height (1881) 61 feet.
From a photograph taken expressly for this work.

trees, with their dark plexus of branches and rigid bristling foliage, extending for a distance of 500 yards in straight unbroken lines. This Avenue was planted in 1843-4 under the direction of the late Mr. James Veitch; it lines a portion of the roadway forming the eastern approach to the mansion. The trees are fifty in number, twenty-five on each side, those on the one side standing precisely opposite those on the other, the interval between every two trees being 63 feet in this direction, and 54 feet in the rows. The height of the trees varies a little, the tallest being (at the present time, 1881) about 37 feet, and the shortest not less than 30 feet. A few have cast off their lowest tier of branches, and there are two or three whose trunks are free of branches to nearly one-third of their height; the uniformity is thus slightly, but not materially impaired. The circumference of the trunks at 3 feet from the ground, ranges from 5 to 6½ feet; the length of the lower branches of the most spreading tree is 17 feet.

The specific name *imbricata*, "overlapping like the tiles on a roof," refers to the tile-like arrangement of the leaves.

Araucaria Bidwilli.—A tree of rapid growth and imposing dimensions, often attaining a height of 150 feet, with branches short in proportion to the height of the trunk. The leaves are in two nearly horizontal rows, ovate-lanceolate in form, very sharply pointed, slightly convex above and concave beneath, leathery in texture, and deep glossy green in colour. The cones are sub-globose, the longer diameter being from 10 to 12 inches, and the shorter 9 to 10 inches they grow points downwards. *A. Bidwilli* is the Bunya-Bunya of eastern Australia, attaining its finest developement in the district between the Brisbane and the Burnett rivers. It is named after Mr. J. T. Bidwill, one of the early botanical explorers of Australia and New Zealand, and for many years a correspondent of the late Mr. James Veitch, Sen., of Exeter. There is a magnificent specimen of *A. Bidwilli* in the Temperate house at Kew.

Araucaria brasiliensis.—A tree from 70 to 100 feet high, with the lower part of the trunk generally free of branches, and with a rounded head; the leaves are oblong lanceolate, much attenuated at the point, loosely imbricated, and deep green. It forms forests of considerable extent on the mountains of southern Brazil, between latitudes 21° and 24° S.

Araucaria Cookii is one of the most remarkable of the tribe. It attains a height (upwards of 200 feet) greatly disproportionate to the diameter of the trunk, and "when growing alone it sheds its lower branches for four-fifths of its height, and then replaces them by a smaller and more bushy growth, so that the tree at a distance

presents a very columnar appearance."* The young plants have a formal but pleasing habit, the branches being frondose, and densely clothed with short awl-shaped imbricated leaves. It is a native of New Caledonia, where it was discovered by Captain Cook in 1774, after whom it is named, and whose companions "thought at first that they beheld a tall column of basalt or some other volcanic product standing aloft in solitary grandeur."

Araucaria Cunninghami,† in its maturity, is a tall tree of 100 feet high and upwards, the trunk being generally divested of branches to the greater part of its height, and with the foliage clustered at the extremities of the branches. The leaves on the sterile branches are needle-like, obscurely four-angled, straight, rigid, and sharply pointed; on the fertile branches they are shorter, stouter, and closely appressed. The young plants cultivated in England have a pyramidal habit, less formal than the other Araucarias; the upper branches are ascending, those below horizontal, and the foliage bright green. It is a native of eastern Australia, in the neighbourhood of the coast, from Moreton Bay northwards, where it covers large tracts of country. It is one of the most useful timber trees in Queensland.

Araucaria Cunninghami glauca is a beautiful variety of the preceding, with silvery glaucous foliage. It is a very handsome conservatory plant.

Araucaria excelsa is a majestic tree growing to the height of 150 feet, with a circumference sometimes upwards of 20 feet. Its trunk rises erect, and is furnished with branches from within 10 or 12 feet of the ground. The branches are horizontal, and, owing to the persistency of the leaves, are always clothed with bright verdant foliage, but which in old trees has a tendency to become tufted at the extremities. In Norfolk Island, its native home, *A. excelsa* generally stands singly and is dotted over the land like the specimen trees in an English park; it is only on the hills that the trees are congregated in clumps. The young plants cultivated in Europe for the decoration of conservatories are symmetrical trees with frondose, deltoid, horizontal, or slightly drooping branches densely clothed with bright green foliage; the leaves are awl-shaped, curved, and sharply pointed. ‡

* R. Abbay in the *Gardeners' Chronicle* of 1877, p. 88.

† Named after Allan Cunningham, favourably known to Science and to Horticulture by his valuable contributions to the Botany of Australia, and by the many fine plants with which he enriched the conservatories and greenhouses of Great Britain.

‡ Dr. Lindley (*English Cyclop.*, p. 290) remarks:—"It is a highly important fact that a plant very nearly the same as *Araucaria excelsa* certainly once grew in Great Britain. Remains of it have been found in the Lias of Dorsetshire, and have been figured in the fossil flora under the name of *Araucaria primæva*." See also Sir Charles Lyell's "*Elements of Geology*, p. 407, where the figure of a fossil cone of an Araucaria found at Bruton, in Somersetshire, is given. The cone itself is preserved in the British Museum.

Araucaria excelsa glauca differs from the species in the colour of its foliage, which is of a lighter green, very glaucous and distinct.

Araucaria excelsa robusta.—A variety larger in all its parts than the usual type, and with foliage of a deeper green.

Araucaria Rulei.—A beautiful and distinct tree 50 feet high and upwards, with horizontal branches and subpendulous branchlets. The leaves of the adult tree much resemble and are nearly as large as those of *A. imbricata*, but more closely appressed to the branches, less sharply pointed, and have a prominent dorsal nerve. In its young state, its habit and appearance is very variable; the branchlets are often quite pendulous, and the leaves are either trigonal by the middle nerve being raised on the upper side, or obscurely four-angled and compressed like those of *A. Cookii*. It is a native of New Caledonia, and was introduced into Europe by us in 1863.

Named in compliment to Mr. John Rule, a horticulturist of South Australia.

Araucaria Rulei elegans is one of the most distinct of the numerous varieties of *A. Rulei;* the whorls of branches are more approximate, the branchlets more slender, and the leaves smaller than in the usual forms. It is a handsome and attractive plant for the conservatory.

Two other species of Araucaria have been described under the names of *Araucaria Balansæ* and *A. Muelleri*. They are both natives of New Caledonia, where they are said to be quite rare.

Allied to the Araucarias, although possessing little external resemblance to them, is a genus of lofty trees confined to New Zealand, Australia, the Malayan and Fiji islands, New Caledonia, and New Hebrides, and generally known by the name of DAMMARA (Rumphius); but Mr. Bentham and Sir J. D. Hooker, *Gen. Plant.*, iii., par. 1, point out that this name, for various reasons, cannot be retained, and that Salisbury's name, AGATHIS, should be accepted. There are eight or ten described species, and probably more that have, up to the present time, escaped the notice of botanists; they are distinguished by their opposite or alternate broad leathery leaves with parallel veins, dicœcious flowers, ovoid or subglobose cones with closely imbricated scales, each bearing one seed. The best known is *Agathis australis*, the Kauri Pine of New Zealand, which forms extensive forests in the northern island, and is one of the most valuable timber trees in the colony.

Tribe II.—TAXODIÆ. The Deciduous Cypress Group.

The Taxodiæ include a group of trees presenting much diversity in their general aspect, but agreeing in the following particulars:—

Their trunks are tall* and erect, and furnished with branches, short in proportion to the height of the tree; their habit is pyramidal or conical during their young state, and till they attain maturity, when their lower branches are generally cast off.

Their flowers are monœcious, that is, the pollen bearing and ovule bearing catkins are produced on the same tree; the fertile cones consist of numerous hard ligneous scales spirally arranged round a common axis, each scale bearing from three to nine seeds, according to the kind.

The Taxodiæ may, therefore, be regarded as occupying in some measure, an intermediate position between the Abietineæ and Cupressineæ, approaching the former in their vegetation, and the latter in their fructification. Their foliage is of various forms, some of which are peculiar, and differ not less strikingly, *inter se*, than from those of every other family of Coniferous trees. Two of the members of the group, Taxodium and Glyptostrobus, are deciduous, all the others are evergreen.

The Tribe includes six or seven genera, none of which consists of more than two or three species; they are polymorphous, and several varieties of the species that have been longest under cultivation have been introduced into gardens. With the exception of *Taxodium distichum*, which has an extensive range in the southern portion of North America, the habitat of all the species is confined to three separate and remote regions in western North America, eastern Asia, and Tasmania.† The Sequoias occur in isolated districts in California;

* Athrotaxis is an exception in this respect.

† It was not always so. The fossil remains of a species of Sequoia closely allied to the Wellingtonia, have been found at Bovey Tracey, in Devonshire, and in the Gault beds of Folkestone. There is evidence to show that the Taxodiæ at one period of the Earth's History were widely distributed, and formed a far more important element in the vegetation of the globe than they do at the present day; and that we may regard those species still existing only in isolated spots, and which comprise, relatively speaking, individuals not indefinitely numerous, as surviving remnants of a remote past vegetation that are gradually passing away to give place to newer forms, but which may be preserved for any length of time by the hand of Man.

Sciadopitys and Cryptomeria in Japan; Glyptostrobus and Cunninghamia in China; and Athrotaxis in Tasmania.*

The economic value of the tribe is restricted to three or four species that yield excellent timber, but which is only used in the countries where these trees are natives. As ornamental trees for the parks, landscape, and gardens of Great Britain, the group includes some of the most important members of the Order, that are not only among the largest, but also among the handsomest of all Coniferæ.

All the members of the Tribe cultivated in Great Britain are enumerated in the following Synoptic Table:—

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
SCIADÒPITYS VERTICILÀTA (*Siebold & Zuccarini*)	*Taxus verticillata* (Thunberg)	The Umbrella Pine	Japan	80 to 100
WELLINGTÒNIA GIGÀNTEA (*Lindley*)	*Sequoia gigantea* (Torrey) ,, *Wellingtonia* (Lawson's *Pinetum Britannicum*) *Washingtonia californica* (Winslow) *Gigantabies Wellingtoniana* (Nelson)	The Mammoth Tree	California ...	250—325
SEQUÒIA SEMPERVÌRENS (*Endlicher*)	*Taxodium sempervirens* (Lambert) *Schubertia sempervirens* (Spach) *Gigantabies taxifolia* (Nelson)	The Californian Redwood	,, ...	200—250
,, adpressa (*Hort.*)	... ...	...	Garden variety...	
,, alba spica (*Hort.*)	... ...	...	,, ,,	

* Professor Parlatore has also included (*Prod.* xvi., pars. 2, p. 442) in the Taxodiæ, the Widdringtonias of South Africa, a genus, including three or four species, one or two of which are but imperfectly known.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
TAXÒDIUM DISTICHUM (*Richard*)	*Cupressus disticha* (Linnæus) *Schubertia disticha* (Mirbel) *Taxodium macrophyllum* (Endlicher)	The deciduous Cypress	South-eastern States of N. America	80—120
,, mexicanum (*Carrière*)	,, *mucronatum* (Parlatore) ,, *Montezumæ* (Decaisne)	The Mexican deciduous Cypress	Mexico	120—130
,, pendulum (*Loudon*)	,, *distichum nutans* (Loudon) ,, *microphyllum* (Parlatore) *Glyptostrobus pendulus* (*Bot. Mag.*, Tab. 5603)	The pendulous deciduous Cypress	Louisiana? ...	30— 40
GLYPTOSTRÒBUS HETEROPHYLLUS (*Endlicher*)	*Taxodium sinense* (Hort.) ,, *heterophyllum* (Brongniart) ,, *japonicum* (Brongniart)	Chinese Water Pine	China	25— 40
CRYPTOMÈRIA ELEGANS (*Veitch*)	... ...	...	Japan	
,, nana (*Veitch*)	... ...			
JAPÒNICA (*Don*)	*Cupressus japonica* (Thunberg)	The Japanese Cedar	,, ...	80—130
,, Lobbi (*Veitch*)	,, *japonica viridis* (Hort.)	Lobb's Cryptomeria		
,, nana (*Fortune*)	... ...	...	Japanese garden variety	1— 2
,, spiralis (*Siebold*)	... ...	...	,, ,,	
CUNNINGHÀMIA SINÈNSIS (*Brown*)	*Pinus lanceolata* (Lambert) *Belis jaculifolia* (Salisbury) *Raxopitys Cunninghami* (Nelson)	...	China	40— 50

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
ATHROTÀXIS CUPRESSOÌDES (*Don*)	*Athrotaxis imbricata* (Maule) *Cunninghamia cupressoides* (Zuccarini)	The Tasmanian Cypress	Tasmania ...	30— 40
LAXIFÒLIA (*Hooker*)	*Athrotaxis Doniana* (Maule)	...	,, ...	20— 25
SELAGINOÌDES (*Don*)	*Cunninghamia selaginoides* (Zuccarini)	...	,, ...	15— 20

Sciadopitys verticillata.—The Umbrella Pine of Japan is a tall tree of conical habit, upwards of 100 feet high, with spreading branches, which are alternate or sub-verticillate, and having leaves clustered at the extremities. The foliage, not less than the habit and general aspect of the tree, forms a distinguishing characteristic in this remarkable Conifer; the leaves are in double whorls, of from twenty to thirty in each (*see* fig. 47), varying in length from 2 to 4 inches, according to the vigour and age of the plant, spreading, leathery in texture, double-ribbed, and obtusely pointed; they are at first of a light fulvous green, but the colour deepens by age, and the mature leaves are deep glossy green, the furrow on the under surface being yellowish, and very distinct. The cones are cylindrical and vary in size from 2 to 4 inches long, and from 1¼ to 2½ inches in diameter. The scales are large in proportion to the size of the cone, broadly wedge-shaped, and each bearing from six to nine seeds; they are arranged round an axis composed of the solid wood of the tree, at the apex of which there is sometimes developed a whorl of perfect foliage leaves.

Habitat.—Japan, on Mount Kojasanin, in the Island of Nippon.

Introduced by us in 1861, through Mr. J. G. Veitch. It was sent to the late Mr. Standish of Ascot about the same time, by Mr. Robert Fortune.

The earliest notice of the Sciadopitys is by Thunberg in 1784, who described it as a species of Yew. Its true character was determined by Siebold, many years afterwards, and who gave it its scientific

name, which is a literal translation of the popular name. It is much cultivated by the Japanese, who possess several sub-varieties of it.

The first living plant was received in England in 1853. In that year Mr. Thomas Lobb obtained one from the garden of the Dutch Governor of Java, which he forwarded to our Exeter Nursery. The plant arrived in very feeble health, and all attempts to restore it proved fruitless. Cones and seeds were sent home eight years later by Mr. J. G. Veitch, from which some of the finest specimens in England were raised. In Sciadopitys we have not only one of the most distinct Conifers, but also one of the most remarkable evergreen trees ever introduced. There is scarcely any department of ornamental planting into which it may not be introduced with excellent effect; and whether planted singly as a specimen, or in combination with other trees and shrubs for contrast and variety, its symmetrical habit and peculiar foliage mark it out as one of the most characteristic of decorative subjects. The experience of the past twenty years has proved its hardiness; and although in this country it is growing under climatal conditions somewhat different from those of its native home, and its growth is rather slow, it makes satisfactory progress when established in good soils and screened from piercing winds.

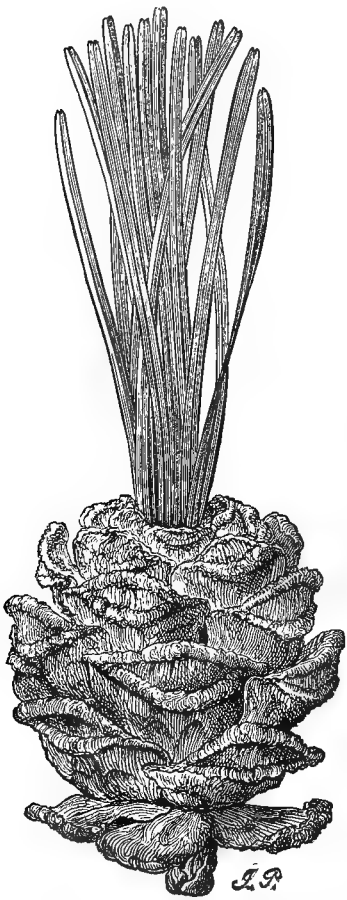


Fig. 46.—Cone of *Sciadopitys verticillata*, with foliage leaves developed at the apex.

Whatever may have been its past history, and that has yet to be unfolded, its restricted habitat and comparative paucity of numbers are significant facts in its present condition. Found wild only in one locality of a limited extent, and in proximity to a dense population, in a country in which the forests are rapidly disappearing, the fate of the Sciadopitys will not remain long in suspense. It will doubtless be preserved indefinitely by the hand of the horticulturist, on whom alone the perpetuation of the tree will ultimately depend.

Sciadopitys is derived from *σκιὰς, σκιάδος* (skias, skiados), "a parasol," and *πίτυς* (pitys), the Pine tree. The specific name, *verticillata*, refers to the whorled arrangement of the leaves. The popular name, "The Parasol Pine," is of Japanese origin, and is said to have been given

to the tree on account of its leaves, which are spread out like the ribs of a parasol.

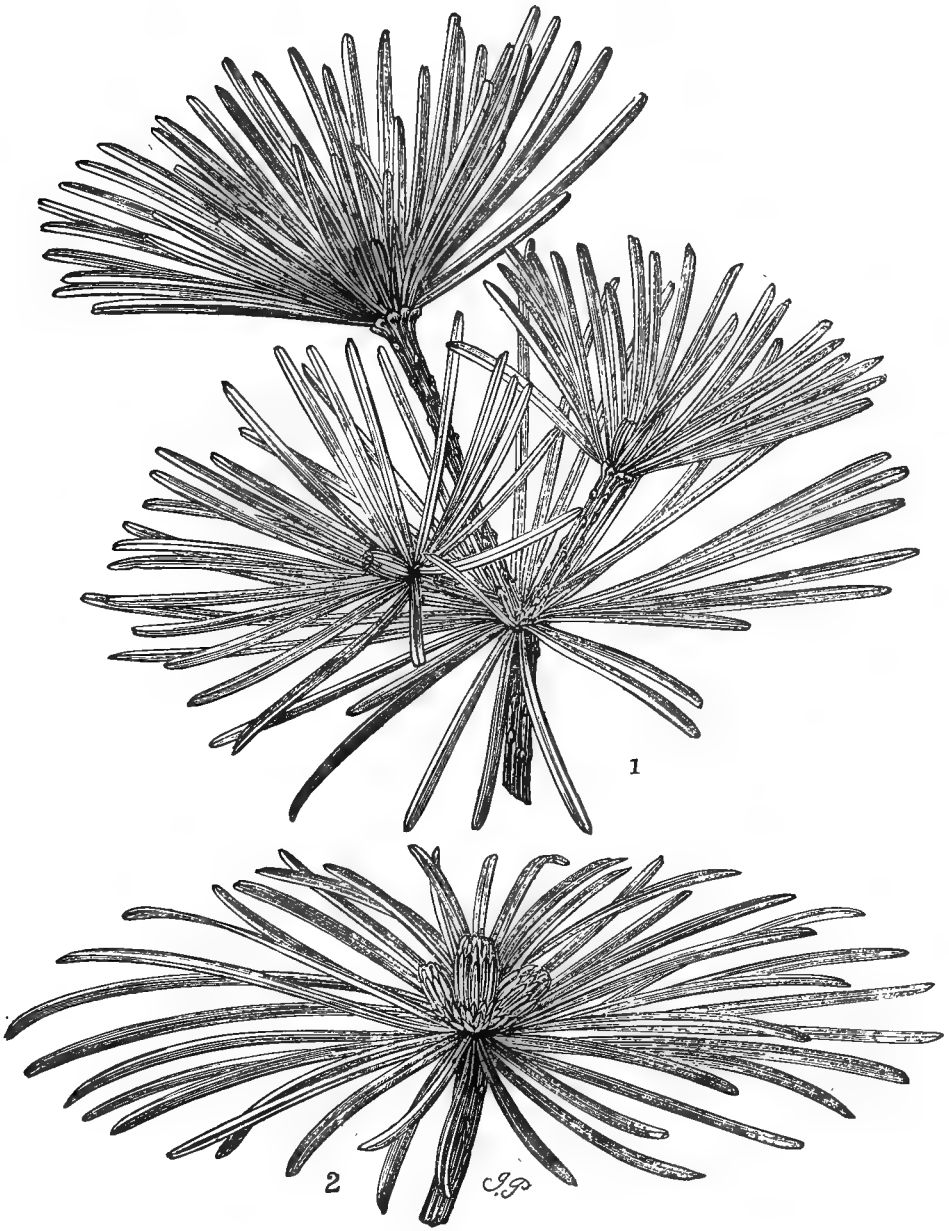


Fig. 47.—Foliage of *Sciadopitys verticillata*. (1) Diminished; (2) natural size.

Wellingtonia gigantea.—The Mammoth tree of California. A tree of gigantic proportions, inhabiting in limited numbers the western slopes of the Sierra Nevada, where it occurs in isolated patches or groves. Although the largest of existing trees,* the Wellingtonia remained unknown to the civilized world till the spring of 1852, when it was accidentally discovered by a hunter, in the employ of the Union Water Company of California, whose duty it was to supply the Company's men with fresh meat.† The spectator, accustomed to the arborescent vegetation of the temperate regions of the old world, or of the Eastern States of America, looking upon a full grown tree for the first time in its native home, beholds it with wonder and astonishment. Its enormous trunk rises to a height of 300 feet, and even more, with a circumference near the base of from 45 to 60 feet,‡ a living column built by the hand of Nature, working silently through centuries of time, and dwarfing by its prodigious bulk and altitude, the grandest pillar ever raised by man. Denuded of branches to as much as one-third of its height, and frequently more, the remainder of the trunk to the summit is irregularly and somewhat scantily furnished with branches that are small in proportion to the gigantic stem from which they spring, and clothed with foliage on their terminal branchlets only. Such is the Wellingtonia in its hoary age in its native home; it is gigantic, ponderous, and imposing, but it cannot be called beautiful.

Very different is the appearance of the young trees in England, now seen in almost every park and garden. These have a straight erect trunk, covered with tough stringy bark, and thickly furnished with branches, gradually contracting in length from the base upwards, so that they present a conical outline, so formal and so sharply defined as to enable them to be readily distinguished from all other trees. The branches are at first horizontal, but in time curve downwards by their own weight, the branchlets being clustered at the extremities, and for the most part ascending, but some are drooping. The leaves are spirally arranged around the branchlets, generally three completing

* Some of the Eucalypti of Australia have attained a greater height than any Wellingtonia at present standing, but the diameter of their trunks is considerably less. Trunks of the Adansonia or Baobab of Africa have been found with a greater diameter, but their height is not proportionate.

† Professor Whitney, *Yosemite Book*.

‡ Professor Whitney, *The Yosemite Book*. That is, at about 10 feet from the ground, above which the trunks taper regularly, but below they are greatly enlarged by projecting buttresses, so that the circumference *at* the ground is often upwards of 100 feet.

the circuit of the stem, and loosely appressed to it in the young plants, but shorter, stouter, and rather closely imbricated in older ones; they are subulate or awl-shaped, embracing the stem at the base, mucronate or pointed, rounded at the back, flat or slightly concave within, glaucous light green when young, deepening in colour by age. The cones are ovoid, obtuse both at base and apex, from

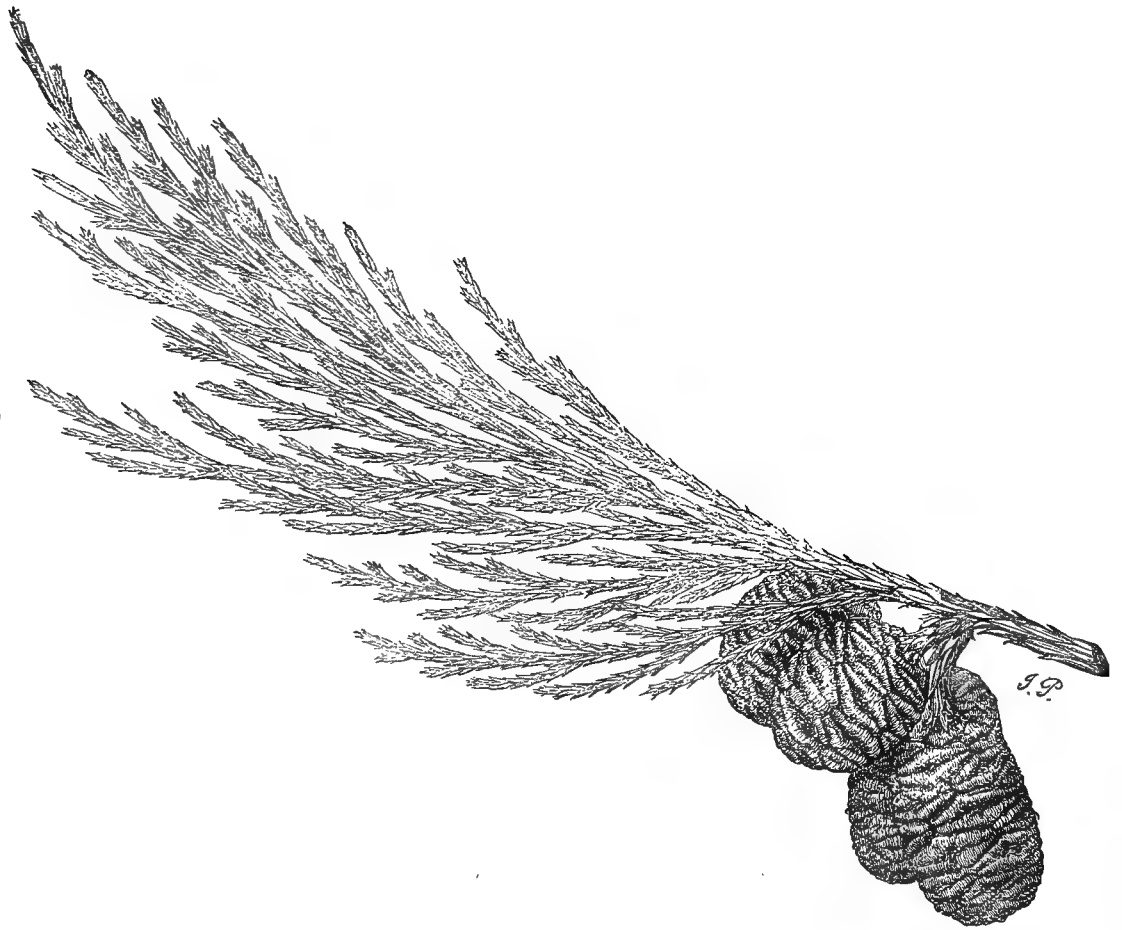


Fig. 48.—Fertile branchlet of *Wellingtonia gigantea*, grown at Linton Park. Natural size.

2 to 2½ inches long, and about 1½ inch broad in the thickest part, bearing spreading scales large in proportion to the size of the cone, and arranged spirally around a thick axis, which is a continuation of the solid wood of the branch on which it is borne. The number of seeds on each scale varies from five to nine.

Habitat.—California, on the Sierra Nevada mountains at 5,000 to 7,000 feet elevation.

Introduced by us in 1853, through our collector, Mr. William Lobb.

Under cultivation the Wellingtonia has shown a tendency to sport into varieties, but none of the forms yet obtained present any striking departure from the usual type. Some of these varieties are distinguished by Horticulturists by names sufficiently indicative of their character, as *glauca, pendula, pygmæa, variegata,* &c.

In the Wellingtonia Avenue, at Linton Park, one of the trees differs in habit and foliage from all the others; the branchlets are more elongated, and quite pendulous, and the leaves longer and deeper in colour. There is also a fine specimen near the great conservatory at Chatsworth, which shows a similar peculiarity.

We subjoin some particulars of special interest connected with *Wellingtonia gigantea.*

For some time past it has been a moot question:—Do we call it by the right name? To this inquiry men of science give an explicit negative, and assign clear reasons for their answer.*

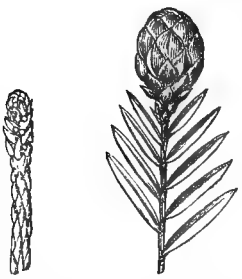
As the nomenclature of this great and popular tree has therefore unfortunately become involved in some confusion, we shall endeavour to state, as briefly as the case admits, how it became so, and we shall include in this statement an account of the origin of the names.

Dr. Lindley named and described the tree from Lobb's specimens, and published his description in the *Gardeners' Chronicle* for December 24th, 1853. In the leading article of the same paper, after stating his reason for believing that the new discovery was quite different from the Redwood, the *Sequoia sempervirens* of Endlicher, he writes:—"The most appropriate name for the most gigantic tree that has been revealed to us by modern discovery, is that of the greatest of modern heroes. Wellington stands as high above his contemporaries as the Californian tree above all the surrounding foresters. Let it then bear henceforward the name of *Wellingtonia gigantea.*" † In his description of the tree, after comparing and noticing the differences between the cones and seeds of Wellingtonia, Sequoia, and Sciadopitys, he adds: "When the male flowers shall have been seen, the Welling-

* The name Wellingtonia has never been generally accepted out of England. From the very first, the propriety of Dr. Lindley's appellative was challenged on scientific grounds, rather assumed than proved, but subsequently strengthened by conclusive evidence. One of the earliest objectors was M. Decaisne, who gave his reasons at a meeting of the "Societé Botanique de France," held in June, 1854. He was closely followed by the late Dr. Torrey, of New York, and Professor Asa Gray, of Cambridge, U.S.A.

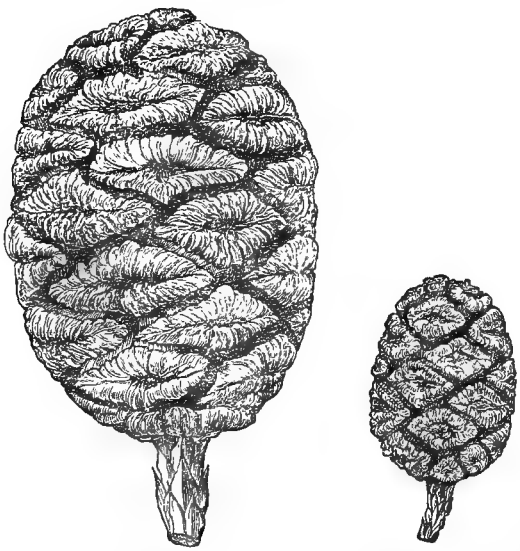
† It will be in the remembrance of many that the public funeral of Wellington in St. Paul's Cathedral had taken place but little more than a year previous.

tonia will be still further distinguished by the structure of these parts." Among the Coniferæ, difference or identity of structure in the male flowers of any two or more kinds is important, and often most important in deciding the generic difference or affinity of those kinds. Dr. Lindley never saw the male flowers of the tree he named; there was no competent botanist, so far as we are aware, in California to examine them till several years afterwards, nor was it until many years after its first introduction that the oldest plants in Great Britain began to produce them. But what do they show? Not the further difference that Dr. Lindley predicted, but an almost perfect identity of structure with those of *Sequoia sempervirens.** To the botanist the conclusion is inevitable, and hence it is that the generic name Wellingtonia has lost ground everywhere except in England, and is replaced by that of the Redwood, *Sequoia*, to which it is so closely allied, as to be no other than a species. Sequoia has priority of designation, and must be retained; it was given by Endlicher, a botanist of acknowledged reputation, to the Redwood (*Taxodium sempervirens* of Lambert), on the discovery of differences essentially generic



1. 2.

Fig. 49.—Male flowers of (1.) *Wellingtonia gigantea*, and (2.) *Sequoia sempervirens*. Natural size.



1. 2.

Fig. 50.—Cones of (1.) *Wellingtonia gigantea* and (2.) *Sequoia sempervirens*, gathered by William Lobb in California. Natural size.

* As regards size the male flowers of Wellingtonia are rather smaller than those of the Redwood, but have larger scales.

The late Mr. A. Murray in the *Gardeners' Chronicle* for 1866, p. 970, writes: "We know that the cones and seeds (Wellingtonia and Redwood) differ in nothing but in size, and even in this, the difference is not so great as the specimens of English-grown cones would lead us to suppose. In California, the cones of the Redwood are often 2 inches long. The marked distinction between the foliage of the two, is, that the leaves of Wellingtonia are imbricated scales, while those of the Sequoia (Redwood) are distichously disposed like the Yew. But the Redwood at different ages dispenses with this character, and has its foliage exactly the same as the Wellingtonia; in this respect exhibiting the tendency to dimorphism, which is common among the Cypresses and Junipers."

between that tree and the deciduous Cypress *(T. distichum)* of the Atlantic States. Endlicher selected his name in honour of "Sequoyah, a Cherokee Indian of mixed blood, better known by his English name of George Guess, who is supposed to have been born about 1770, and who lived in Will's Valley, in the extreme north-eastern corner of Alabama. He became known to the world by his invention of an alphabet, and a written language for his tribe. This alphabet, which was constructed with wonderful ingenuity, consisted of eighty-six characters, each representing a syllable, and it had already come into use to a considerable extent before the whites had heard anything of it. Driven with the rest of his tribe beyond the Mississippi, he died in New Mexico in 1843. His remarkable alphabet is still in use, although destined to pass away with his nation, but not into oblivion, for his name attached to one of the grandest and most impressive productions of the vegetable kingdom will for ever keep his memory green." *

The habitat of the Wellingtonia, for so it will be called in England for a long time to come, is remarkable. The trees occur in isolated patches or groves along the western slopes of the Sierra Nevada for about 180 miles parallel with the crest. There are eight of these groves, all of them included between latitudes 36° and 38° 15′ N., or extending but little beyond these parallels. The Calaveras Grove, where the tree was first discovered, and where William Lobb obtained the first supply of cones and seeds brought to England, is the most northerly; it is about 200 miles east from San Francisco; and one on the south fork of the Tule is the most southerly. The vertical range is also limited; the trees nowhere descend much below 5,000 feet above sea level, nor above 7,500 feet; their highest elevation is towards their southern limit, and they occur lower down proceeding northwards.

Not only is the habitat restricted to the narrow limits above described, but also the Sequoia (Wellingtonia) exists in "numbers so limited that the trees of the different groves have been counted, except near their southern limit, where they form a colossal forest 40 miles long and 3 to 10 broad, whose continuity is broken only by the deep sheer-walled cañons that intersect the mountains.† A species limited to individuals holds its existence by a precarious tenure, and this (the Wellingtonia) has a foothold only in a few sheltered spots of a happy mean in temperature and locally favoured with moisture in summer. Even there, for some reason or other, the Pines ‡ with which it is associated, the Firs,§ and even the Incense Cedar, ‖ possess a great advantage; and though they strive in vain

* Professor Whitney, *The Yosemite Book.*

† Sir J. D. Hooker, *Address to the Members of the Royal Institution*, April, 1878.

‡ *Pinus ponderosa* and *P. Lambertiana.* § *Abies grandis* and *A. concolor.*

‖ *Libocedrus decurrens.*

to emulate the size, they wholly overpower the Sequoias in numbers. The force of numbers eventually wins. At least in the commonly visited groves, *Sequoia gigantea* is invested in its last stronghold; it can neither advance into more exposed positions above, nor fall back into drier and barer ground below, nor hold its own in the long run where it is, under present conditions; and a little further drying of the climate, which must have been much moister than now, would precipitate its doom. Seedlings of the big trees occur, not rarely indeed, but in small proportion to those of the associated trees; and small indeed is the chance that any of these will attain to the days of the years of their fathers."*

The earliest reports of the extraordinary bulk of the "Big Trees," although much in excess of the reality, tended greatly to excite public interest in them, which can scarcely be said to have been diminished by the more accurate information respecting their dimensions subsequently received. Actual measurement made by authority of the United States Government, of the largest Wellingtonias standing in the groves of the Sierra Nevada, showed the tallest of them to be 325 feet in height, and 45 feet in circumference at 10 feet from the ground. There are but three others whose heights exceed 300 feet, the circumference of one of them, called "The Mother of the Forest," being as much as 61 feet at 10 feet from the ground.† The heights of the next six tallest range from 284 to 272 feet, and their circumferences from 49 to 41 feet. These ten trees are all in the Calaveras Grove, at the northern limit of the tree. No tree yet observed in any of the other groves has attained so great a height as these, and generally speaking, the height appears to diminish in proceeding from north to south, or inversely, to the elevation at which they are growing. The tallest tree in the Mariposa Grove was found by measurement to be 272 feet high; and the heights of the next six tallest ranged between 271 and 250 feet, with circumferences, at 10 feet from the ground, of from 60 to 40 feet.‡ The largest known Wellingtonia is prostrate; it is called by the settlers around the Calaveras Grove "The Father of the Forest," and its height, when standing, could not have been less than 350 feet.

The immense size of the trees naturally led to conjectures as to the *ages* of some of the "full grown giants," but which, in the first instances, were enormously in excess of the reality. The earliest

* Professor Asa Gray, *Address to the American Association for the Advancement of Science*, 1872. Professor Whitney has pointed out another cause which has hastened the extinction of the Wellingtonia in its native home:—"The ravages of the forest fires have been most destructive; the light wood is rapidly consumed, although the bark appears to have some power of resistance.

† It was the bark of this tree, stripped off to 116 feet of its height, that was brought to England for exhibition, and set up in the Crystal Palace, at Sydenham, where it remained till it was totally destroyed by the disastrous fire of December 30, 1866.

‡ Professor Whitney, *The Yosemite Book*.

approximation to the truth was obtained by Professor Whitney, the State Geologist of California, by counting the rings of a felled tree in the Calaveras Grove. This tree was 24 feet in diameter, exclusive of the bark, and contained one thousand two hundred and fifty-five annual rings at a section of the trunk made 30 feet from the base. "There was a small cavity in the centre of the tree which prevented an accurate fixing of the age; but making due allowance for that, and for the time it required to grow to the height at which the count was made, it will be safe to say that this particular tree, which was probably about as large as any standing in the grove, was, in round numbers, one thousand three hundred years old." Further evidence as to the age attained by the Wellingtonias was more recently supplied to Sir J. D. Hooker, by Mr. Muir, who communicated the following particulars to the members of the Royal Institution in an address delivered in April, 1878. "A tree felled in 1875 had no appearance of age; it was 69 feet in girth, inside the bark, and the number of annual rings, counted by three persons, varied between two thousand one hundred and twenty-five and two thousand one hundred and thirty-nine. Another was 107 feet in girth, inside the bark, at 4 feet from the ground; its wood was very compact, but showed throughout a considerable portion of the trunk, thirty annual rings to the inch. This, if the rings were of uniform diameter, would give the incredible age of six thousand four hundred years; but as the interior rings of such trees are much broader than the outer, half that number to the inch is a more conceivable estimate, which would give an age of three thousand five hundred years." Nevertheless, it is not too much to assume that few, if any, of the existing Wellingtonia ante-date the Christian era, or that, with very few exceptions, the oldest of them reach within five hundred years of that epoch, and whose age, therefore, does not much exceed that of some of the oldest Yews in Great Britain.

Very little can be said about the economic value of the Wellingtonia. "No known timber is so excessively light, soft, and brittle; its bark is tough, spongy, and stringy in texture, and seems to be largely charged with a crimson-coloured matter, exuding and hardening into a substance like gum. It is a form of tannin, and the Wellingtonia may thus supply a substitute for Oak bark." *

The Wellingtonia has proved quite hardy in England, Ireland, and the greater part of Scotland. It grows in all ordinary soils in which water does not stagnate, but evidently prefers light, rich, and deep soils, in open airy places, but not exposed to piercing winds. In such situations its growth is rapid, and it becomes a handsome symmetrical tree in a few years. In heavy soils its growth is slower, and its habit in consequence more dense. Under all circumstances the trunk increases in thickness with a rapidity greater in proportion to

* Lawson's *Pinetum Britannicum, Sequoia Wellingtonia*, page 13.

the height than that of most other large Coniferous trees, the circumference at the base being often as much as one-fifth of the height. In *Abies Douglasii* the circumference of the trunk at the base is generally not more than one-eighth or one-tenth of the height, and this proportion is not much exceeded in other tall Conifers, as *Pinus Lambertiana*, *Abies nobilis*, &c.

From the returns published from time to time in the horticultural press during the past ten years, and supplied by the owners of fine Wellingtonias scattered throughout the country, or by gardeners under whose charge they are, we find that the annual average rate of growth has ranged from 18 to 33 inches after the first three or four years from the seed; the trees which made the most rapid growth being in the south-west and south of England, while the others were further north, the diminution in average yearly growth agreeing generally with diminished annual average temperature and rainfall. Like all other Conifers, the Wellingtonia will not live under the influence of smoke, and it should, therefore, never be planted as a memorial tree in the immediate vicinity of large towns. For whatever purpose it is planted, a space having a radius of not less than 20 feet should be allowed for it, and a free circulation of air on all sides should be secured.

Numbers of fine specimens in all parts of Great Britain attest the complete acclimitisation of the Wellingtonia. The largest of which we have any cognisance, is growing at Powderham Castle, near Exeter, the seat of the Earl of Devon; this fine tree is now over 60 feet high, the girth of its trunk at 3 feet from the ground exceeds 10 feet, and its lower branches cover a space having a radius of about 16 feet. Other remarkable specimens may be seen at Poltimore Park, Exeter; Kenfield Hall, Canterbury; Redleaf, Penshurst, Kent; Singleton, Swansea; Bicton, Devon; Highnam Court, Gloucester; Arundel Castle, Sussex, &c., &c.

The facility with which the Wellingtonia has adapted itself to the climate of Great Britain, is partly explained by Professor Gray's account of the climatal conditions under which it has flourished on the slopes of the Sierra Nevada, and which he describes "as a happy mean in temperature locally favoured with moisture in summer." For centuries the wonder, and probably the worship of the wild man who roamed through the silent Californian forests, its discovery has been its revival; it has been infused with a new vigour; it has received, as it were, a new life in a new home, where its future will be the beautifying of the lawns and parks formed to minister to the pleasures and relaxations of busy civilized life; but where also, removed from the present by geological ages, its remote progenitors had once reared their lofty heads in the primeval forests inhabited by the huge mastodon and elephant, and at a time when the rhinoceros and other uncouth *Pachydermata* wallowed in the swamps and marshes of these islands.

Sequoia sempervirens.—The Californian Redwood takes the second place in size among the gigantic Coniferous trees of north-west America, attaining a height of nearly 300 feet,* but this is exceptional; the height of 200 feet with a girth of from 30 to 40 feet at 10 feet from the ground is common. The enormous trunk is covered with a very thick spongy bark, tinged with a reddish colour, a hue that also pervades the wood, whence the popular name of the tree. The upper portion only of the trunks of full-grown trees is furnished with branches, and this but sparingly, but the younger trees do not exhibit so great a disproportion between the trunk and the branches.† The foliage is dimorphous; on young trees the leaves are long, linear, flat, spreading, distichously disposed like those of the Yew, and almost as deep in colour; in old trees they are often acicular and closely appressed like those of the Wellingtonia. The cones are ovoid, from 1 to 2 inches long, and differ but little, except in size, from those of the Wellingtonia.

Habitat.—California, near the Pacific coast, from San Luis Obispo to the Oregon boundary, a narrow belt extending for about 500 miles.

Introduced by Hartweg in 1846.

Sequoia sempervirens adpressa has its leaves shorter, stouter, and inclined to the branchlets at a much more acute angle than in the usual type. The foliage and young growth is glaucescent.

A very distinct variety that originated in the nursery of M. Leroy, at Angers, in France.

Sequoia sempervirens alba spica is a garden variety, with more slender branchlets and smaller leaves than those of the species. The foliage is glaucous, and the tips of many of the branchlets creamy-white.

In its scientific aspect and associations, the Redwood is one of the most interesting of trees, whether we regard it as a singular surviving representative of the vegetation of a former epoch that has well nigh disappeared, or look upon it simply in its relationship with existing Coniferæ. In the geological system called the Miocene, *Sequoia sempervirens*, or species closely allied to it, were widely distributed over the

* Dr. Newberry in *Pacific Railway Report*, p. 15.

† Like the Wellingtonia, the Redwood swells at the base near the ground.

eastern Continent in high latitudes. "As a fossil, their geographical range extends from Greenland, latitude 70° N., to Sinigaglia in Italy, latitude 44° N.; and in an east and west direction from the Hebrides (Isle of Mull), to the Steppe of the Kirghis,"* and, from recent discoveries, also to Spitzbergen, northern Asia, &c.; it is remarkable too that the Miocene fossil plants found in latitude 83° N. during the late Arctic expedition under Sir G. Nares, includes the Redwood, or its near ally, *Taxodium distichum*. From the time of its greatest developement, and through the succeeding periods, the Redwood gradually disappeared from the vast area over which it was spread, till it finally receded to the strip of territory along the Pacific coast of north-western America; it is now confined to a narrow belt that extends, with occasional interruptions, for about 500 miles. Although in numbers it at present exceeds its gigantic congener, the Wellingtonia, by millions; the extreme restriction of its habitat cannot fail to be noted as a significant fact in its present history.

The Redwood was discovered by Mr. Archibald Menzies, in 1795, from whose specimens Mr. Lambert figured and described it in his great work, *The Genus Pinus*, under the name of *Taxodium sempervirens*. Nothing more was heard of it till David Douglas visited California in 1831, but he, from some cause not now known, failed to introduce it into England. Dr. Coulter, who travelled in California in 1836, was the next botanist to make mention of it, but no seeds were received from him. Ten years later Hartweg, when collecting for the Horticultural Society of London, succeeded in sending to England the first consignment of cones and seeds to which any authentic date can be assigned, but Mr. Gordon affirms that it was introduced into Europe by the Russians in 1843, or three years earlier than the receipt of Hartweg's consignment.†

The Redwood is the most valuable of all the Californian timber trees to the inhabitants on the coast and in the immediate neighbourhood of the districts where it abounds, but rather on account of its cheapness and abundance than from any superior qualities it possesses. The wood is light, brittle, close in grain, and of a beautiful red colour, which renders it desirable for indoor carpentry; it splits with peculiar facility by means of wedges, so that it can be made into planks without the use of a saw. On exposure to the weather it shrinks endwise, but not across the grain.‡ Owing to the accessibility of the Redwood forests, due to their proximity to the coast, and to their being traversed by innumerable streams, the consumption of Redwood timber is proceeding at a rate that would almost exceed belief,

* Sir C. Lyell, *Geology*, p. 260.

† *Pinetum*, p. 380. Carrière says it was introduced in 1840, but gives no particulars. *Traité Général des Conifères*, p. 211.

‡ Mr. C. Nordhoff in *Harper's Magazine*, from *The Garden*, vol. v., p. 83.

were it not attested by reliable statistical facts. Saw mills and logging camps are established along the coast, where the immense trunks are reduced to useful timber with a prodigious waste of wood. More destructive still are the operations of the sheep farmer, who fires the herbage to improve the grazing, and whose flocks of tens of thousands of sheep devour every green thing, and more effectually than the locust."

During the last quarter of a century the Anglo Saxon has been ruthlessly carrying fire and the saw into the forests of California, destroying what he could not use, and sparing neither young nor old, and before a century is out, the two Sequoias may be known only as herbarium specimens and garden ornaments; indeed, with regard to the "Big Trees," the noblest of the noble Coniferous trees, the present generation, which has actually witnessed its discovery, may live to say of it, that "The place that knew it shall know it no more."* The Redwood is, however, remarkable for its tenacity of life, the stumps and roots of the felled trees throwing up for a long time great numbers of vigorous suckers.

The *Sequoia sempervirens* in England, notwithstanding that it flourishes in a warmer climate in California than its gigantic congener, is a fast-growing pyramidal or conical tree of dark aspect. It has a tendency to commence its growth very early in spring, and to continue growing till late in the autumn, which renders it extremely liable to injury by winter and spring frosts, so that the leader and terminal shoots of the branches are sometimes destroyed; the trunk thence becomes forked, and the outline of the tree irregular; the foliage is frequently discoloured or "browned" from the same cause. For these reasons the Redwood has not been regarded with so much favour as might have been expected from so remarkable a tree. It is, however, a fine tree, which should be included in every collection of ornamental Conifers, and planted in every park where it can be sheltered from cold piercing winds, and where a space with a minimum radius of 25 to 30 feet can be allowed for it to develope its fine proportions. A moist but well drained soil is the best for it, and, as might be expected, it thrives well in the neighbourhood of the coast, in the south and south-west of England, and in the south and west of Ireland.

The specific name, *sempervirens*, "evergreen," refers to the persistent foliage.

Taxodium distichum.—A large tree with an erect trunk, from 80 to 120 feet high, and from 25 to 40 feet in circumference. When young it presents a pyramidal outline with slender spreading

* Sir J. D. Hooker, *Address to the Members of the Royal Institution*, April, 1878.

branches, but after arriving at maturity, the upper branches frequently lengthen, and the tree then assumes a broad Cedar-like aspect. The foliage, which is deciduous, is light and open, bright, but soft and pleasing green, which changes to dull red before it falls in autumn. The leaves are pinnate, the leaflets being arranged in two horizontal rows, like the teeth of a comb, on opposite sides of the midrib; they are from a quarter to half an inch in length, narrowing a little at the apex, and slightly curved. The cones are about the size of a small walnut, very uneven owing to the projection of the thick scales, which are striated or marked with a series of longitudinal lines.

Habitat.—The south-eastern States of North America, from Delaware, in latitude 38°51′ N., southwards to Florida; thence westwards through Louisiana and Texas into the Mexican Territory, its southern limit being Oaxaca, in latitude 17° N. Also on the west side of the Mississippi from Missouri to eastern Texas.

Introduced into England by Tradescant about 1640.

Taxodium distichum pendulum is a slender tree, from 25 to 40 feet high, with horizontal branches and short branchlets, which are at first nearly erect, but become pendulous and deciduous in autumn. The leaves on the young shoots are twisted and appressed to the stem, but become more expanded and spread out like those of the common form as the season advances.

This is a very beautiful variety, deserving of greater attention than it has hitherto received at the hands of horticulturists. A moist retentive soil, and a somewhat sheltered situation are necessary conditions for its well being. Neglect of these has led to frequent failures, and doubtless the disfavour into which this form of the deciduous Cypress has fallen. There are some fine specimens in the grounds of Robert Barclay, Esq., at Bury Hill, Dorking.

Under cultivation *Taxodium distichum* has a tendency to sport in the seed beds, and numerous varieties have thence at different times been selected and named by horticulturists.* But it is now well-known that although the deciduous Cypress in its maturity presents considerable diversity as regards habit, the striking differences observed in young plants gradually diminish by age, and that the trees, as they

* Loudon (*Arb. et Frut.*, p. 2481) gives the names and descriptions of several of these forms. Carrière (*Traité Général des Conifères*, p. 181), describes fifteen varieties, and Henkel and Hochstetter (*Nadelhölzer*, p. 260) select five.

grow older, approach more and more nearly to a general type, in which individual differences are too insignificant to call for a separate designation. By far the most distinct of the varieties is the one above described, of the origin of which nothing certain is known.

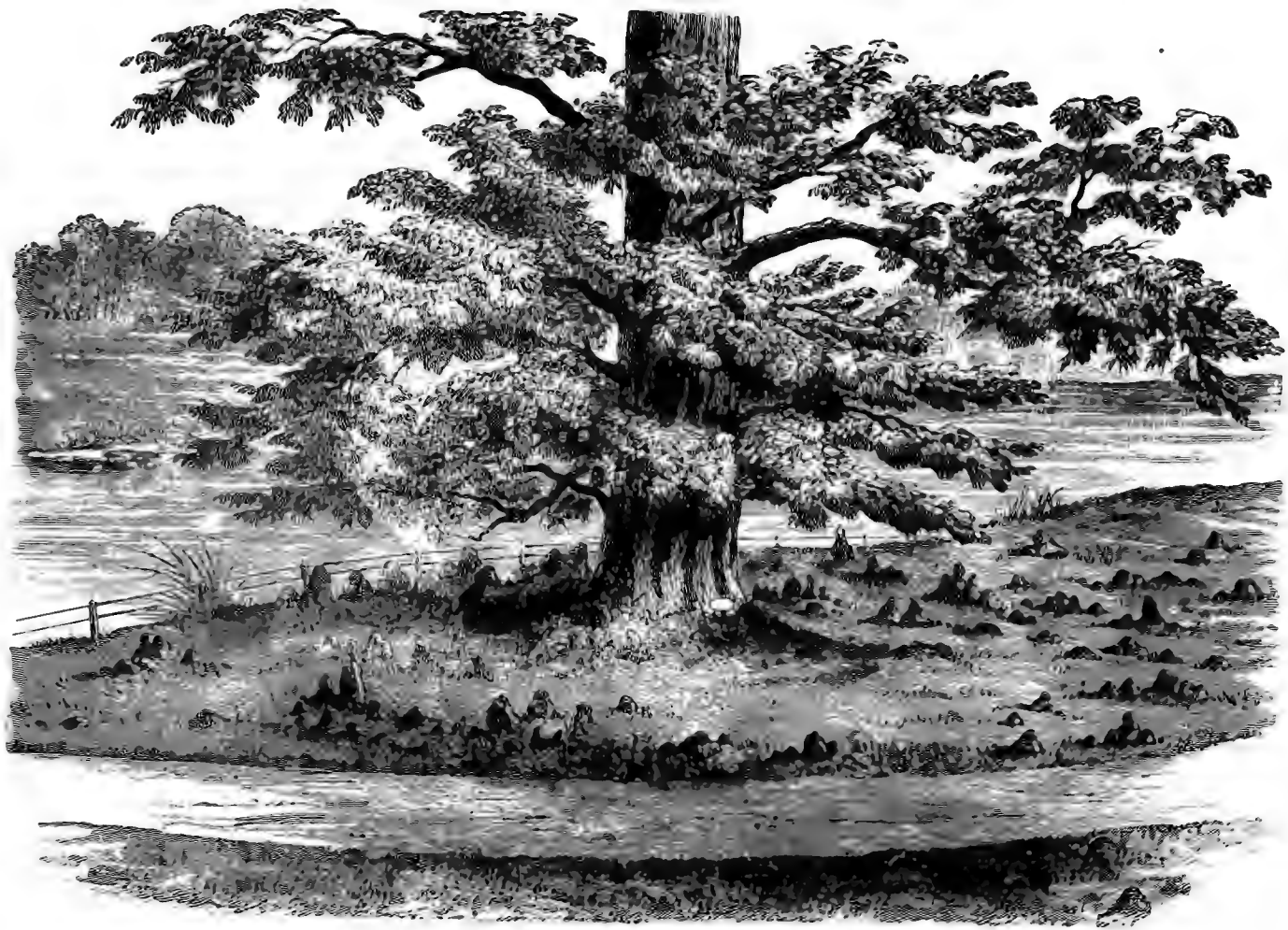
Taxodium distichum is a semi-aquatic tree, attaining its finest developement on the banks of rivers and amidst marshes and swamps, and is nowhere met with at any distance from them. In those situations the trunks attain an enormous diameter in comparison with the height; the tallest known tree scarcely exceeds 120 feet in height, but many have been met with whose circumferences have been found by measurement to be 40 and 45 feet, or as much as one-third of the height; the circumferences of the largest Wellingtonias are not greater than one-fifth or one-sixth of their heights. Like the Sequoias, the trunks of the deciduous Cypress swell out into large buttresses at the base, but to such an excessive extent, that in order to fell the trees with the smallest expenditure of labour, it is necessary to erect a stage at from 5 to 6 feet from the ground.

"The roots of large trees, particularly in situations subject to inundations, become covered with conical protuberances, commonly from 18 inches to 2 feet high, and sometimes from 4 to 5 feet in thickness; they are always hollow, smooth on the surface, and covered with a reddish bark like the roots, which they resemble, also in the softness of their wood. No cause has been assigned for their existence, they are peculiar to the deciduous Cypress, and begin to appear when it is from 20 to 25 feet high. They are made use of by the negroes of the Southern States for bee-hives."* In England these protuberances or "knees" are rare; at Syon House, the seat of the Duke of Northumberland, where are some of the finest deciduous Cypresses in Britain, "knees" have been produced, as is shown in the accompanying woodcut.

The economic value of *Taxodium distichum* is very great throughout the region in which it is abundant. This tree is to the inhabitants of the Southern States what the Redwood is to those on the Pacific coast of California, and it is used for much the same purposes. The wood is light but strong, fine in grain, and splits easily into shingle without the aid of a saw; it is of a reddish colour, of deeper hue than the Virginian Red Cedar, very durable, and almost imperishable in water; it is much used for posts, fencing, railway sleepers, &c.

The deciduous Cypress is quite hardy, and its great importance as an ornamental tree in Great Britain is mainly due to two circumstances, the peculiarly pleasing soft colour of its light feathery foliage, combined with its graceful habit, and its adaptability for planting in close proximity to water, and in damp places where few other Conifers will live. It is, comparatively speaking, of rather slow growth, but

* Loudon, *Arb. et Frut.*, p. 2483.



Taxodium distichum, with "knees," at Syon House, Isleworth. Present height (1881) 90 feet. The "knees" extend 60 feet from the bole.

in rich moist soil it makes from 5 to 6 feet in six or eight years from seed, and about 15 feet in from twelve to fifteen years,* its average yearly growth not often exceeding 12 inches. The deciduous Cypress should never be planted in dry elevated situations.

Taxodium from τάξος (taxos) the Yew, and εἶδος (eidos) "external appearance," from the resemblance of the foliage to that of the Yew;† and δίστιχος (distichos) "arranged in double rows."

Taxodium Mexicanum, or *T. Montezumæ*, is the Mexican representative of the deciduous Cypress, from which it is distinguished "by the less size, fresher green, and more slender and tapering character of its twigs and leaves."‡ It is too tender for the climate of Great Britain; in its native country it attains a greater size than the common form in the United States. There is a gigantic specimen at Santa Maria del Tule, in Oaxaca, which has a circumference of 124 Spanish feet, or about 115 feet English. Another tree of historic interest stands in the Garden of Chapultepec, near Mexico; it is called "the Cypress of Montezumæ" by Humboldt, and it is the tree under which Cortes, the Spanish Conqueror of Mexico, passed the night§ after the defeat and expulsion of the Spaniards from the city.

Glyptostrobus heterophyllus.—A shrub or low tree from 8 to 10 feet high, with an erect stem. The branches are scattered or alternate, the lower ones spreading or slightly decumbent, those above partially erect and spreading. The leaves are of various forms; in the primary branches they are scale-like, on the secondary ones linear-subulate, obscurely three-angled, spreading, and of a dull green colour. The cones are small elongated ovoid bodies, less than an inch long, composed of closely imbricated scales, the fertile ones bearing two winged seeds.

Habitat.—China, in the neighbourhood of Canton, and along the banks of the river Whampoa. The limits of its distribution have not yet been ascertained.

Introduced into Europe early in the present century.

The special interest attached to *Glyptostrobus heterophyllus* is purely scientific. It is the only representative of the genus at present known,

* Loudon, *Arb. et Frut.*, p. 2484.

† The resemblance is much greater in the Californian Redwood, formerly called *Taxodium sempervirens.*

‡ Lawson, *Pinetum Britannicum*, part 36.

§ La noche triste. "La battalla nocturna en la calzada fue la mas horrorosa y funesta para los españoles, é hizo en ellos impresion tan dolorosa, que desde entonces le dieron el sobrenombre de noche triste."—*Solis Conquista de Mejico*, Lib. iv., cap. 19.

and like its nearest allies, the Taxodium and the Sequoias of North America, it may be regarded as a relic of a former vegetation, among which its progenitors were once widely distributed.

The Glyptostrobus possesses no attraction for the horticulturist. Less hardy than the deciduous Cypress, and far less handsome, it not only requires a moist situation but also a sheltered one, and although introduced to European gardens many years ago it has never been extensively propagated. The few specimens still living in this part of the world are those that received an asylum in collections of rare and curious plants.

Glyptostrobus, from γλυπτὸς (gluptos), "sculptured," in reference to the markings on the outer face of the scales of the cone, and στρόβος (strobos), "a whirl, or whirling motion;" or perhaps the tree "Strobus" mentioned by Pliny is meant. (*See* page 184.)

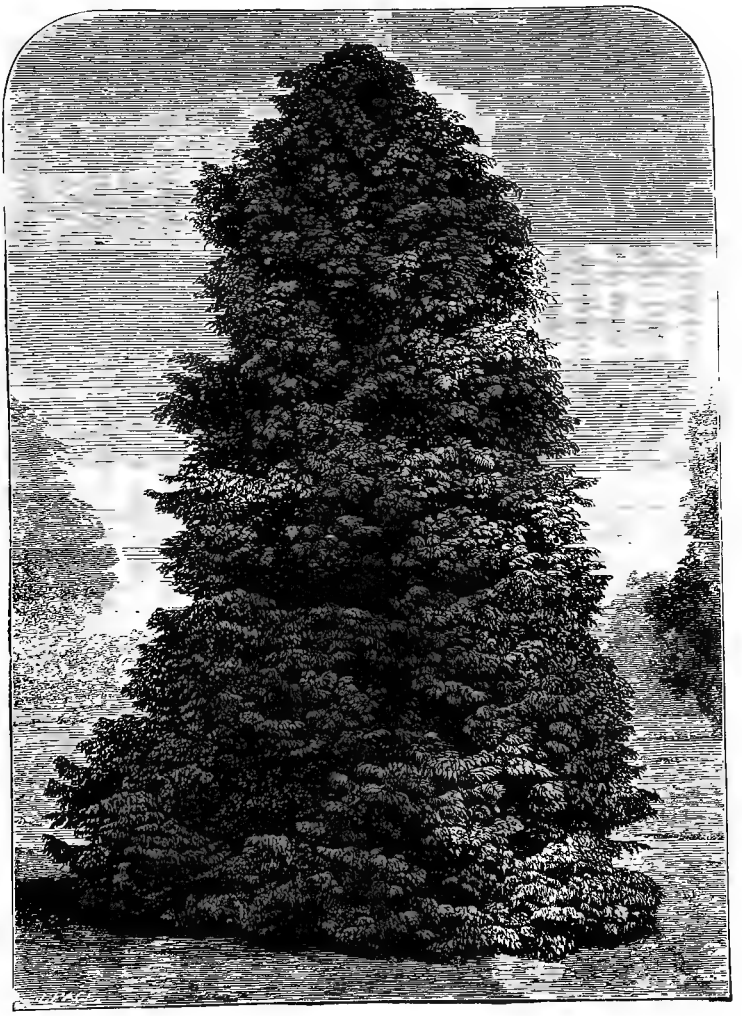
The specific name, *heterophyllus*, refers to the various forms of the leaves. By Bentham and Hooker (*Gen. Plant.*, vol. iii., p. 429) the Glyptostrobus is referred to Taxodium.

Cryptomeria elegans.—A beautiful tree with a robust upright trunk, furnished with short horizontal branches, and branchlets pendulous at their extremities. The foliage and young growth during the growing season is bright green, but towards the end of autumn the colour changes to a bronzy-crimson, by which the plant is rendered a most striking and attractive object during the winter months. The leaves are linear, flattened, soft in texture, decurrent at the base, sharply pointed, spreading, more or less falcate, marked both above and beneath by a shallow groove, and less crowded than in *C. japonica*. The cones are not distinguishable from those of *C. japonica*.

Fig. 51.—Fertile branchlet of *Cryptomeria elegans*. Grown at Linton Park.

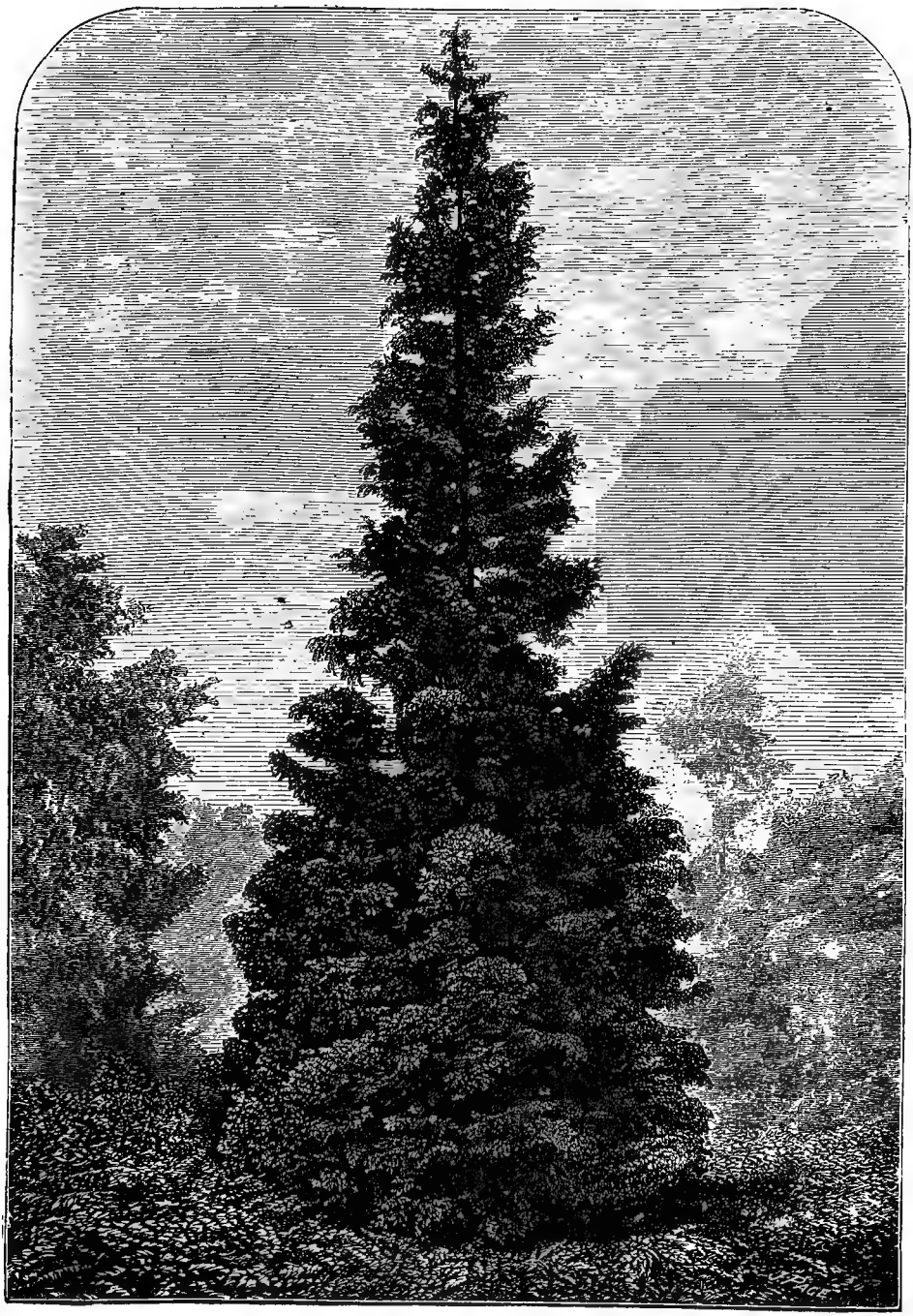
Introduced from Japan in 1861, by Mr. J. G. Veitch, who met with it only in cultivation in the neighbourhood of Yokohama.

Cryptomeria elegans nana.—A low, dense, bushy shrub, with leaves more crowded and more slender than the preceding. It



Cryptomeria elegans at Linton Park, near Maidstone.

Present height (1881) 20 feet.



Cryptomeria Lobbi at Dropmore. Present height (1881) 46 feet.

retains in all its intensity the glowing crimson hue of *C. elegans* during the winter months, with the exception of the pendulous tips of the branchlets, which continue green.

Cryptomeria elegans is so distinct from *C. japonica* that we have preferred describing it as specifically different, although it has, we believe, never been met with in a wild state. It is quite hardy, and is comparatively free from the drawbacks that have proved so disappointing in *C. japonica*, especially during the winter months. On account of the peculiar and remarkable change in colour which the foliage undergoes at the end of autumn, together with its pleasing habit, a first rank among out-of-door winter decorative plants is justly assigned to it. The resemblance of *C. elegans* during the growing season to *Araucaria Cunninghami* is very apparent, and it thus, in a great measure, supplies in the open ground the place of that beautiful but tender tree.

Cryptomeria japonica.—A large tree of elongated spiry outline, with an erect tapering trunk, attaining a height of from 120 to 150 feet, and even more. The branches are numerous, produced at irregular intervals around the trunk, frondose and spreading, the lower ones deflexed with the extremities ascending; the branchlets are very numerous, generally alternate, and with their foliage bright fulvous green during the growing season, which changes to a deeper and duller colour in winter. The leaves are close-set, appressed to the stem, obscurely four-angled, thick and decurrent at the base, falcate, pointed, and faintly marked with two glaucous lines beneath. The cones are globular, about half an inch in diameter, and composed of numerous scales bearing from three to five seeds each.

Habitat.—Japan, abundant on some of the mountain slopes, where it constitutes the chief part of the forests, from their base to 1,500 feet of elevation; also frequent in China under cultivation.

Introduced into England in 1844 by the Horticultural Society of London, through their collector, Mr. Robert Fortune, who sent seeds from Shanghai.*

Cryptomeria japonica Lobbi is more compact in habit than the tree above described; the branchlets are less pendulous, the foliage is of a brighter and deeper green, the leaves shorter, more

* *Gardeners' Chronicle*, 1845, p. 344.

pointed, and more closely appressed to the branchlets. It was sent to us from the Botanic Garden at Buitenzorg, in Java, by Mr. Thomas Lobb in 1853.

Cryptomeria japonica nana.—A small procumbent bushy shrub, rarely exceeding 2 feet in height. It is useful for the rock garden, and for adding variety to a collection of small Coniferous plants.

Cryptomeria japonica spiralis.—A very curious and interesting variety, of slender habit. The falcate leaves are so closely appressed as to give them the appearance of a spiral thread wound round the branchlets.

Other varieties have been called respectively *araucarioides, dacrydioides, monstrosa,* &c., all of which have been introduced from Japanese gardens.

The Cryptomeria is one of the finest trees in Japan. It has received assiduous attention from Japanese horticulturists for centuries past, who possess many useful and interesting varieties of it, including those above described. It is not only common in gardens throughout the country, but it is also planted to form avenues along the public roads, especially along the approaches to spots associated with important historic personages or events. One of the finest of these avenues, and probably one of the most remarkable of its kind in the world, is that leading from the town of Namada through Outsonomeya to Nikko, celebrated as the burial place of one of the greatest of Japanese rulers in former times. This avenue extends for a distance of 50 miles, and consists chiefly of *Cryptomeria japonica*, the trunk of every tree being as straight as an arrow, and averaging from 130 to 150 feet in height, by 12 to 15 feet in circumference at the base. The avenue is not straight the whole distance, but has many windings, which enhances its effect. It was planted by one of the old feudal lords about three hundred years ago, and was presented by him to the then Shogum or Military Ruler of the country. There is another fine avenue of Cryptomerias on the Hakoni road to Fusi-Yama, extending for several miles.

Dr. Siebold has pointed out* that the Cryptomeria introduced by Mr. Fortune, from China, is not the true Sungi, or Cryptomeria of Japan, but a variety of it, differing from the Japanese species in having its branchlets pendulous, and the ultimate branchlets longer; the leaves are also much longer, more slender, and more bent. The true Sungi is distinguished by its more spreading and stiffer

* *Fl. Jap.*, II., p. 48, 1870.

branchlets, more pyramidal habit, shorter leaves, and deeper green colour. Seeds of the Japanese Cryptomeria were sent by Dr. Siebold to the Dutch Botanic Garden at Buitenzorg, in Java, so long ago as 1825, and one of the trees raised from this seed was the parent plant of those brought to us from the same garden in 1853, by Mr. Thomas Lobb, from which originated all those now cultivated under the name of *Cryptomeria japonica Lobbi*. It is, therefore, evident that the latter is the true *C. japonica*, although Siebold affirms that it differs from the Japanese type in its lighter green foliage, but this difference is too trifling to affect the main fact. It would be a more correct nomenclature for the tree at present known in British gardens as *C. japonica*, to be called *C. japonica Fortunei*, and that known as *C. japonica Lobbi*, to be called *C. japonica*.

The economic value of the Cryptomeria in its native country is very great; it grows in all situations and soils, in deep wet valleys and high up mountain sides; it is, thence, one of the commonest, as it is also one of the most useful, of Japanese timber trees. The wood is of a reddish colour, light, soft, fine in grain, and easily worked; it is used for all kinds of carpentry and joinery. Owing to the frequent occurrence of earthquakes in Japan, which necessitates the building of houses entirely of wood, and, on the other hand, the destructive fires which sometimes lay waste a whole town in a few hours, the consumption of Cryptomeria timber proceeds at a rapid pace.

In England the Cryptomeria has proved to be hardy, but good specimens are comparatively rare in this country, owing, probably, to climatal causes, the most potent being a less annual rainfall, and a lower average summer temperature than in Japan. It is only in deep rich soils, with abundance of moisture, and protected from piercing winds, that the Cryptomeria develops the fine ornamental qualities it is seen to possess in its native country, and when planted in such spots, a clear space having a radius of not less than 15 feet should be allowed for it.

Cryptomeria is formed from κρυπτὸς (kruptos), "hidden," and μέρος (meros), "a share or part." The name was given by Professor Don, on account of its obscure relationship to the Cedar. The popular name in Japan is Sungi, or the evergreen Fir; it is not unfrequently called the Japanese Cedar in England.

Cunninghamia sinensis.—A medium-sized tree of Araucaria-like aspect, from 40 to 50 feet high in its native country, but much less under cultivation in Europe. Its trunk is straight and cylindrical, the branches short, spreading horizontally, at first regularly verticillate, subsequently in the older trees becoming very irregular. The leaves are from 1 to 2 inches long, without foot-stalks, lanceo-

late, sharply pointed, rigid, coriaceous in texture, the margins roughened by slight serratures, yellowish-green above, two broad glaucescent bands beneath, and with a mid-rib running up the centre; they are two-rowed in direction (sub-distichous) owing to a slightly oblique twist at the base. The cones are of ovate form, erect, from 1 to 1½ inch in length, and composed of numerous imbricated coriaceous persistent scales, each bearing three seeds.

Habitat.—Southern China.

Introduced into England in 1804, by Mr. William Kerr, under instructions from the Directors of the East India Company.*

> The Cunninghamia cannot be said to have adapted itself to the climate of England. Although there are specimens of considerable size scattered over the country, which have withstood the severest winters known, the tree cannot be considered very hardy. The foliage is discoloured by the frost of an ordinary winter, and it has accordingly an unhealthy appearance, which, with its somewhat scantily furnished trunk and branches, deprives it of the ornamental qualities it undoubtedly possesses in its native country. With so many disadvantages, the Cunninghamia can only be regarded as an interesting curiosity worthy of preservation, as an illustration of the vegetation of a period separated from the present by geological ages.
>
> It was named in compliment to Mr. James Cunningham, who discovered it in the neighbourhood of Canton, in 1702.

Athrotaxis.†—A genus of evergreen trees or shrubs, with numerous jointed branches, clothed with coriaceous imbricated foliage, and bearing small ovate cones about the size of a hazel nut, composed of many scales, having from three to six seeds in each. The species are all natives of Tasmania, where they are restricted to a few localities, and occur in limited numbers. They were introduced to British gardens between the years 1847 and 1850, and have proved comparatively hardy. Their Lycopod or Selaginella-like aspect renders them very distinct, and when planted in good soil in sheltered situations they are very ornamental, and useful for contrast.

Athrotaxis from ἀθρόος (athroos), "crowded together," and τάξις (taxis), "arrangement," in reference to the crowded arrangement of the scales of the cones.

* Loudon, *Arb. et Frut.*, p. 2446.

† "Errore *Arthrotaxis* auctorum fere omnium." Bentham and Hooker *Gen. Plant*, vol. iii., p. 430.

Athrotaxis cupressoides.—A medium-sized tree, from 30 to 40 feet high, with numerous branches; the branchlets are covered with small thick coriaceous leaves, spirally arranged, closely imbricated, and glossy deep green in colour. It occurs in damp situations, in the neighbourhood of Lake St. Clair and of the Pine River, near Marlborough.

Athrotaxis laxifolia.—A low tree, from 20 to 25 feet high, much resembling *A. cupressoides*, with the leaves longer, more pointed, and instead of being closely appressed to the branches, are open and spreading. It is found on the banks of a small stream called the Meander, also on the Western Hills, at an elevation of 4,000 feet.

Athrotaxis selaginoides.—A low tree or shrub, of variable height, quite distinct from either of the preceding. The branches and their ramifications are very numerous; the leaves scale-like, spirally arranged, closely appressed to the branchlets, and deep fulvous green. It is perhaps the hardiest of the Athrotaxes. It occurs at the cataracts of the Meander, at an elevation of about 4,000 feet.

Tribe III.—CUPRESSINEÆ. The Cypress Tribe.

The Cypress Tribe consists of trees and shrubs of dense growth, the former being generally of fastigiate or columnar habit, but there are some that have spreading branches, and attain the dimensions of timber trees; the latter are either erect, spreading, procumbent, or prostrate, frequently diminutive in size, and formal in outline. Amidst this great diversity in habit, there is, however, throughout the Cypress Tribe a much nearer approach to uniformity in the aspect of the trees and shrubs included in it, than is seen in either of the two tribes already described, owing chiefly to their compact growth and the simple form and structure of their evergreen foliage.

The general characters which distinguish the tribe are—

The branches and branchlets are very numerous, crowded, and much ramified, the ramification being produced laterally

only in most of the kinds, giving the branch a flat or Fern-like form; in a few others they are produced on all sides of the primary.

The foliage is dimorphous; the leaves of the young seedlings and of the sterile branches are linear, or needle-shaped; on fertile branches they are imbricated scale-like, closely appressed to the stem, and arranged in opposite pairs.

The flowers are monœcious in most of the species; the cones are small spherical bodies, rarely exceeding an inch in diameter, but frequently much less, and consist of hard, ligneous, peltate scales, occasionally with angular or spiny projections, arranged in opposite pairs (decussate), each scale bearing numerous seeds.

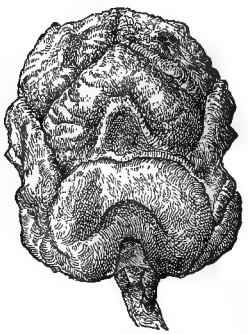


Fig. 52.—Strobile, or cone, of *Cupressus macrocarpa*. Natural size.

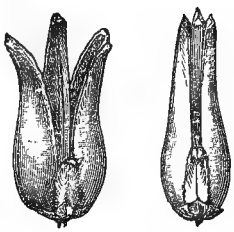


Fig. 53.—Strobile, or cone, of *Libocedrus decurrens*. Natural size.

A deviation from some of these general characters is seen in the cones of Thuia and Libocedrus, which are ovate-oblong, with the scales not peltate; and in the Junipers, in which the acicular leaves are arranged in threes, and in many species of which the leaves never or only partially assume the scale-like form. In the Junipers, also, the flowers are generally dicœcious, and the scales of the fruit fleshy, and of a deep purple colour, giving it a berry or drupe-like form.

With the exception of the Junipers, which are spread over the eastern and western Continents from the Tropic of Cancer to the Arctic Circle, the geographical distribution of the Cupressineæ may be stated roughly as being confined to two comparatively narrow zones, nearly equi-distant from the equator. In the eastern Continent the northern zone lies between the 30th and 45th parallels; in America between the 25th and 50th. The southern zone includes portions of South America, Africa, and Australia, also the islands of Tasmania and New Zealand, all lying between the 30th and 45th parallels. The trees belonging to the Cypress

tribe rarely form forests like those of the Fir and Pine tribe, but are found intermixed with the trees and shrubs of other Orders, not always sparingly, but often in groups of considerable extent. On the mountain sides, they occur at a lower elevation than the Pines and Firs.

The economic value of the tribe, as regards the application of its timber to constructive purposes, is insignificant compared with that of the Firs and Pines. There are not many of the species that attain dimensions large enough to supply planks in sufficient quantity or of sufficient size to be serviceable beyond the localities in which the trees are growing, and consequently timber produced by trees belonging to the tribe, with two or three exceptions,* rarely forms an article of commerce. The special properties of the wood of the most important species will be noticed in their respective descriptions.

In Great Britain the value of the tribe consists almost exclusively in the ornamental qualities possessed by the species and varieties included in it, that are sufficiently hardy for our climate. As decorative garden plants, their importance can scarcely be overrated; their formal and compact growth, the limited space they require, the variety they afford in the colour of their foliage, which is often variegated with the richest yellow, and sometimes with white, and the strong contrast they make to the trees and shrubs of other Orders, render them among the most attractive as well as the most popular of garden plants.

I.—CUPRESSUS (*Tournefort*). The Cypress.

The Cypresses are tall or medium-sized evergreen trees, natives of the warmer parts of the north temperate zone, chiefly in the south of Europe, the Levant, China, California, and Mexico. There is much diversity in habit among the different species, the branches of some being erect, of others spreading, and in one of the Chinese species, when the tree has arrived at maturity, they are pendulous, like those of a Weeping Willow. The branchlets of some kinds are rigid and ascending, or spreading, and of others, feathery or drooping, and the foliage of nearly all the species is remarkable for richness and depth of colouring, to which a silvery glaucous hue is frequently superadded.

* The wood of the Bermuda and Virginian Junipers is much used in the manufacture of pencils and penholders. The timber of the *Retinosporas* is a considerable item in Japanese commerce, and that of *Libocedrus tetragona* is shipped from southern Chili to many of the ports of South America on the Pacific coast.

Being natives of a warmer climate than that of Great Britain, the Cypresses, with the exception of three or four of the North American species, are much liable to injury, and are not unfrequently killed by severe frosts; but in the south and west of England and Ireland they grow freely, and form handsome specimens in a short time. *Cupressus Lawsoniana* and *C. nutkaënsis* coming from a higher latitude than the other species, are found to withstand our severest winters without injury, and they are consequently among the most useful, as they are among the most beautiful of ornamental Conifers. All the Cypresses under cultivation are found to sport more or less into varieties, some of which are very distinct from the usual type, especially in the case of the hardier species just named, a circumstance which greatly enhances their value as decorative plants.

In the south of Europe and China the Cypress has been associated with sepulchral monuments from remote antiquity. The Greeks and Romans regarded its evergreen character as an emblem of immortality, and in China the weeping habit of the Funereal Cypress has always been looked upon as the symbol of grief, and for that reason it is planted over the graves of departed friends.

Cupressus, which is the Latin form of κυπάρισσος (kuparissos), is the ancient name of *Cupressus sempervirens*, the Cypress of Scripture, Mythology, and the Classical Poets.

The modern dismemberment of the genus Cupressus, by which three of the species, together with Retinosporas, are brought under Chamæcyparis,* does not find favour among British Horticulturists. The sole character on which the so-called genus Chamæcyparis is founded, consists in the scales of the fertile catkins having but two ovules instead of several, as in most Cypresses. Sir J. D. Hooker has shown conclusively that in *Cupressus Lawsoniana* this distinction has completely broken down, and that the reference of this species and *C. nutkaënsis* to Chamæcyparis is "utterly futile."† As Siebold's Retinospora rests on no better foundation, consistency would require that we should refer the species of Retinospora to Cupressus; but the generic name under which they were introduced has become so firmly established in garden nomenclature, that a change of name in these popular Conifers would at present meet with but little, if any, acceptance. By Mr. Bentham and Sir J. D. Hooker in their recently published *Genera Plantarum* (Pars. i., vol. iii.), Chamæcyparis is made a Section of Thuia (Thuya).

* Chamæcyparis from χαμαὶ (chamai), "on the ground," and κυπάρισσος (kuparissos), the Cypress—one of Spach's numerous creations.

† *Botanical Magazine*, 1866, Tab. 5587.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
CUPRÈSSUS FUNÈBRIS (*Endlicher*)	*Cupressus pendula* (Staunton	The Funereal Cypress	North-east China	40 to 50
GOVENIÀNA (*Gordon*)	*Cupressus californica* (Carrière) ,, *Hartwegii* (Carrière)	Gowen's Cypress	South California	15— 20
KNIGHTIÀNA (*Gordon*)	,, *elegans* (Hort.) ,, *Lindleyana* (Klotsch)	Knight's Cypress	Mexico	45— 60
LAWSONIÀNA (*Murray*)	*Chamæcyparis Boursieri* (Carrière) ,, *Lawsoniana* (Parlatore) *Cupressus attenuata* (Gordon)	Lawson's Cypress	North California	75—100
,, alba spica (*Hort.*)	... ...	The white speckled Lawson's Cypress	Garden variety	
,, albo-variegata (*Hort. Veitch*)	... ...	The white variegated Lawson's Cypress	,, ,,	
,, argentea (*Hort. Waterer*)	*Cupressus Lawsoniana glauca* (Hort.)	The silvery Lawson's Cypress	,, ,,	
,, argenteo-variegata (*Hort. Lawson*)	... ...	...	,, ,,	
,, aureo-variegata (*Hort. Waterer*)	*Chamæcyparis Boursieri aurea* (Carrière)	The golden variegated Lawson's Cypress	,, ,,	
,, erecta viridis (*Hort. Waterer*)	... ...	The erect Lawson's Cypress	,, ,,	
,, filiformis (*Hort.*)	... ...	...	,, ,,	
,, gràcilis pendula (*Hort. Barron*)	... ...	...	,, ,,	
,, intertexta (*Hort.*)	... ...	...	,, ,,	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
CUPRÈSSUS LAWSONIÀNA lutea (*Hort. Rollisson*)	... ...	The yellow Lawson's Cypress	Garden variety	
,, nàna (*Hort.*)	*Chamæcyparis Boursieri nana* (Carrière)	The dwarf Lawson's Cypress	,, ,,	
,, ,, àlba (*Hort.*)	... ...	...	,, ,,	
,, ,, glaùca (*Hort.*)	*Cupressus Lawsoniana minima* (Hort.)	...	,, ,,	
LUSITÀNICA (*Miller*)	*Cupressus glauca* (Lamark)	Cedar of Goa	Portugal and S.W. Spain	40— 50
MACNABIÀNA (*Murray*)	*Cupressus glandulosa* (Hooker) ,, *nivalis* (Lindley)	MacNab's Cypress	North California	10— 15
MACROCÀRPA (*Hartweg*)	*Cupressus Lambertiana* (Gordon)	The large fruited or Lambert's Cypress	South California	50— 60
,, fastigiàta (*Murray*)	... ...	The upright Lambert's Cypress	,, ,,	50— 60
NUTKAËNSIS (*Lambert*)	*Chamæcyparis nutkaensis* (Spach) *Thuiopsis borealis* (Fischer)	The Nootka Sound Cypress	British Columbia and Oregon	40— 50
,, argènteo-variegata (*Hort.*)	... ...	The silver Nootka Sound Cypress		
,, aùreo-variegata (*Hort.*)	... ...	The golden Nootka Sound Cypress	Garden variety	
,, compàcta (*Hort.*)	... ...	The dwarf Nootka Sound Cypress	,, ,,	4— 6
,, glaùca (*Hort.*)	... ...	The glaucous Nootka Sound Cypress	,, ,,	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
CUPRÈSSUS SEMPERVÌRENS (*Linnæus*)	*Cupressus fastigiata* (De Candolle)	The upright Roman Cypress	South of Europe and Asia Minor	60—100
,, horizontàlis (*Parlatore*)	,, *horizontalis* (Miller)	...	South of Europe and the Levant	50— 75
,, indica (*Parlatore*)	,, *Whitleyana* (Gordon) ,, *Roylei* (Carrière) ,, *australis* (Hort.)			
THYOÌDES (*Linnæus*)	*Chamæcyparis sphæroidea* (Spach)	The White Cedar	Eastern States of North America	40— 70
,, glaùca (*Hort.*)	*Chamæcyparis Kewensis* (Knight)	...	Garden variety	
,, Hòveyi (*Hort.*)	,, *Hoveyi* (Hort.)	...	,, ,,	
,, leptoclàda	see *Retinospora leptoclada.*			
,, nàna (*Loudon*)	*Chamæcyparis sphæroidea nana* (Endlicher)	The dwarf White Cedar	Garden variety...	1— 2
,, variegàta (*Loudon*)	,, *sphæroidea variegata* (Endlicher)	The variegated White Cedar	,, ,,	
TORULÒSA (*Don*)	*Cupressus cashmeriana* (Hort.) ,, *nepalensis pendula* (Hort.)	The tufted Cypress	Himalayas ...	50— 70
,, Corneyàna (*Carrière*)	,, *Corneyana* (Knight)	Corney's Cypress	...	20— 25

Cupressus funebris, the Chinese Funereal Cypress. A remarkable tree, attaining a height of 50 feet, and presenting striking changes in its aspect during its progress from the seed to maturity. The young plant is clothed with needle-like leaves of a light glaucous hue, and resembles some of the cultivated forms of Retinospora. As it becomes

older these are succeeded by scale-like, closely appressed, imbricated yellowish-green leaves; it is then of erect habit, with horizontal branches which lengthen as the tree arrives at maturity, when they become pendulous at their extremities, and from these main branches, others long and slender, hang down towards the ground, giving the whole tree a weeping and graceful form.*

Habitat.—China, the north-east provinces, from the Hang-chow River to the Great Wall.†

Introduced in 1846 by Mr. Robert Fortune.

The Funereal Cypress first became known to Europeans during Lord Macartney's Embassy to Pekin in 1792, when it was seen in the "Vale of the Tombs," in north China. Mr. Fortune met with it about 150 miles up the Hang-chow River, in the neighbourhood of the far-famed tea country of Whey-chow, 10° farther south, from whence he sent the first seeds received in England to Messrs. Standish & Co., of Bagshot, by whom plants were subsequently distributed. Mr. Fortune also saw this Cypress farther west, where it is more common; and "frequently in clumps on the sides of the hills, where it had a most striking and beautiful effect on the Chinese landscape." The expectation that the Funereal Cypress would prove as hardy in England as the Indian Deodar or *Cryptomeria japonica*, has not been realised. Its growth is slow, and it is liable to injury in severe weather, especially by cold winds, by which the young branchlets are killed and the plant much disfigured. If seed could be procured from the northern limit of its habitat, where the rigour of the climate is fully equal to that of ours, it is highly probable that a hardier race would be obtained, and that this remarkable tree may yet be employed in the decoration of the parks, pleasure-grounds, and cemeteries of Great Britain, for which it is one of the most distinct and effective known. In Sikkim, where it is an introduced plant, its fragrant red wood is burnt in the temples for incense.‡

Cupressus Goveniana.—A low tree or shrub, of dense habit, with spreading branches and bright green foliage; the branchlets are numerous, irregularly disposed, and slender, the leaves scale-like, and closely imbricated. In the early spring this plant is covered with innumerable yellow male catkins, which, for the time, give it a very striking appearance; so plentifully is the pollen produced, that

* Mr. Robert Fortune, in the *Gardeners' Chronicle* for 1850, p. 228.

† *Gardeners' Chronicle*, 1850, pp. 228, 437.

‡ Sir J. D. Hooker, *Himalayan Journals*, vol. i., p. 315.

when shed, the ground beneath appears covered with yellow dust; this species is thence very fertile, and is covered with cones even in its young state.

Habitat.—California, in the neighbourhood of Monterey.

Introduced in 1846 by the Horticultural Society of London, through their collector, Hartweg, and named in compliment to J. R. Gowen, Esq., at that time Secretary of the Society.

Cupressus Knightiana.—A tall tree of elegant habit, with drooping, feathery, and fern-like branchlets, and well distinguished by the glaucous bluish hue of its foliage.

Habitat.—The mountains of Mexico, at a considerable elevation.

Introduced about 1840, probably by Hartweg.

> *Cupressus Knightiana* is the hardiest of the Mexican Cypresses, and the only one from that country available for planting in England, but it requires a sheltered situation. It was named in compliment to Mr. Knight, of the firm of Knight and Perry, our predecessors at the Royal Exotic Nursery, Chelsea. It has now become quite rare.

Cupressus Lawsoniana.—A tall tree, attaining a height of upwards of 100 feet. The trunk is slender in proportion to the height, not exceeding 2 feet in diameter near the base; the branches short and spreading, the branchlets pendulous, fern-like, and feathery, the leader pendulous like that of the Deodar, and the foliage deep glaucous green, which, in the early spring, is relieved by bright crimson male catkins that are terminal, numerous, and produced while the trees are still young. The cones or strobiles are about the size of large peas, and are borne in great profusion.

Habitat.—Northern California, on the Shasta Mountains; in the neighbourhood of Port Orford, and in other parts of Oregon.

Introduced in 1854 by Mr. William Murray, who sent seeds to Messrs. Lawson, of Edinburgh.

From the numerous varieties of *Cupressus Lawsoniana* in cultivation, the following are selected for their effectiveness as decorative plants:—

Cupressus Lawsoniana alba spica.—In this variety the terminal growth and tips of the branchlets are creamy-white. It is a plant of rapid growth, less dense than the common form.

Cupressus Lawsoniana albo-variegata.—A dwarf compact variety, of conical habit. The branchlets and foliage are of the deepest green, profusely spotted and blotched with white.

It originated in our Coombe Wood Nursery.

Cupressus Lawsoniana argentea has longer and more slender branches than in the type; the foliage is very glaucous, of almost silvery whiteness.

It originated in the Nursery of Mr. Anthony Waterer, at Knap Hill, Woking.

Cupressus Lawsoniana argenteo-variegata has many branchlets and leaves creamy-white, interspersed among the deep green foliage, characteristic of the type.

It originated in the Nurseries of Messrs. Lawson, at Edinburgh.

Cupressus Lawsoniana aureo-variegata resembles the usual type in habit, but differs from it in having many of its branchlets of bright yellow.

It originated in the Nursery of Mr. John Waterer, at Bagshot.

Cupressus Lawsoniana erecta viridis has a fastigiate and tapering habit, with foliage of a lighter and brighter green than the species, which it retains through the winter months. It is one of the most ornamental and distinct of all the upright Cypresses.

It originated at the Nursery of Mr. Anthony Waterer, at Knap Hill.

Cupressus Lawsoniana filiformis.—A singular variety, having its branches excessively elongated at the expense of the lateral branchlets. It is of sub-pendulous habit.

Cupressus Lawsoniana gracilis pendula.—In this variety the branches are long, and gracefully pendulous. It is a handsome lawn plant of very vigorous growth.

It originated in the Nursery of Messrs. Barron & Son, of Borrowash, near Derby.

Cupressus Lawsoniana intertexta.—A variety more robust in all its parts, so that the ultimate branchlets appear more divaricate

than in the common form. The foliage has a peculiar glaucous hue quite unlike that of any other variety.

Cupressus Lawsoniana lutea has the whole of the young growth of a light clear yellow, which subsides to a deep yellow in winter. It is a plant of medium growth and compact habit, and it is quite distinct from the variety *aureo-variegata*.

Cupressus Lawsoniana nana.—A diminutive variety of slow growth, dense in habit, globose in outline, and deep green in colour.

Cupressus Lawsoniana nana alba.—A dwarf compact little plant, with the whole of the young growth yellowish-white, which deepens to light green when mature.

Cupressus Lawsoniana nana glauca resembles the variety *nana* in its dense dwarf globose habit, but differs in its highly glaucous foliage.

Cupressus Lawsoniana possesses almost every quality that renders a Coniferous tree valuable for British gardens. As an ornamental tree, it is one of the handsomest. It is perfectly hardy; the severest winters that have occurred since its introduction have scarcely affected it. It thrives in almost every description of soil, wet and cold peat alone being unfavourable for it. It is remarkably prolific, bearing seed in abundance even in its young state, which quickly germinates, and thus it may be propagated with great rapidity. It is polymorphous, giving rise to varieties so distinct from the normal form, and so varied in habit and outline, that several of them are justly ranked among the best of subjects for the geometrical or formal flower garden, both in summer and winter. It may be used for almost every purpose for which Conifers are planted—as a single specimen for the lawn or park, in groups of its own kind, or intermixed with other trees or shrubs, for evergreen hedges, or as a funereal or cemetery tree.

It was named in compliment to Mr. Charles Lawson, of Edinburgh, head of the well-known horticultural firm of Peter Lawson & Sons, and, for one term, Lord Provost of the city.

Cupressus Macnabiana.—A low tree, of compact bushy habit, from 10 to 15 feet high, with short branches, thickly set, and slightly ascending at their extremities; the branchlets are numerous, rigid,

and clothed with small scale-like deep green foliage, arranged in four rows, and very glaucescent.

Habitat.—Northern California, on the Shasta Mountain.

Introduced in 1852 by the Oregon Association, through their collector, John Jeffrey.

It was named in compliment to Mr. McNab, the late respected Curator of the Edinburgh Botanic Garden.

Cupressus macrocarpa.—A large tree of vigorous growth, variable in habit under cultivation. The branches are numerous, close set, and in the usual type, horizontal with the extremities ascending; the secondary branches are generally lateral and opposite, but they are also produced from all sides of the primaries, especially in the fastigiate variety. The foliage is of the brightest green, by which this species is easily distinguished from every other.

Habitat.—California, in the neighbourhood of Monterey.

Introduced in 1838, by Mr. A. B. Lambert.*

Cupressus macrocarpa fastigiata has its branches ascending and closely pressed around the trunk. It resembles in habit the upright Roman Cypress.

The two forms of *Cupressus macrocarpa* above described are said to have originated from different sources. The spreading kind was introduced by Mr. Lambert, who sent seeds to the Horticultural Society of London without any specific name, and the plants raised from them were called *C. Lambertiana*, in compliment to the donor. This variety became widely distributed, owing to the facility with which the Cypresses can be propagated by cuttings, and is still familiarly known in gardens as *C. Lambertiana*. In 1846, Hartweg, at that time collecting for the Horticultural Society in California, sent home seeds of this Cypress under the name of *C. macrocarpa*, which he gave it on account of the large size of its fruit or strobiles. The plants raised from these seeds were fastigiate in habit, and had an erect or continuous leader. Although Hartweg's name, *macrocarpa*, was given subsequently to Gordon's *Lambertiana*, the former has priority of publication, and is therefore retained. It is now well known that plants raised both from Californian and European grown seeds vary much in habit, and that forms intermediate between the spreading habit of Gordon's *C. Lambertiana* and the fastigiate growth

* Gordon's *Pinetum*, p. 92.

of the *C. macrocarpa* of Hartweg are of frequent occurrence, but that the former and its modifications are the most numerous.

Cupressus macrocarpa is a beautiful tree, tolerably hardy in the south and west of England. For the spreading or horizontal branched variety a space having a radius of not less than 20 feet should be allowed; the lower branches of some of the finest specimens in England having attained that length. *C. macrocarpa* is patient of the knife, and may be pruned or headed back without injury; it is, therefore, a good plant for forming tall evergreen hedges in a sheltered situation. Although a grand tree it cannot be recommended for the formation of avenues, on account of the diversity of habit which it assumes, whether raised from seed or from cuttings.

Cupressus nutkaënsis.—The Nootka Sound Cypress, in its native country, is said to be a tall tree attaining a height of from 80 to 100 feet, and having a rounded top.* Under cultivation it is of elongated pyramidal or nearly columnar form. The branches are sub-erect or spreading, the branchlets distichously arranged, with the extremities elegantly recurved and densely clothed with imbricated closely appressed leaves, which are keeled at the back and sharply pointed. This Cypress greatly resembles *C. Lawsoniana*, from which it may be distinguished by its having sulphury-yellow instead of red male catkins, by its more robust habit, and its paler green foliage.

Habitat.—Vancouver's Island, British Columbia, and Oregon, chiefly between the 45th and 55th parallels.

Introduced about 1850, from the Botanic Garden at St. Petersburgh.

Cupressus nutkaënsis argenteo-variegata has many of its terminal branchlets creamy-white, with the laterals more or less spotted with the same colour.

Cupressus nutkaënsis aureo-variegata has the same habit as the type, with its green foliage varied here and there by sprigs of light yellow.

Cupressus nutkaënsis compacta is of dwarf dense growth,

* Dr. Newberry, *Pacific Railway Report*, p. 63, describes the individuals he saw as "trees of moderate size, having much the appearance of *Thuia occidentalis*, when growing under the most unfavourable circumstances."

having its stem much divided, and its branchlets smaller than in the species.

Cupressus nutkaënsis glauca differs from the species only in the appearance of the foliage on which the glaucescence is much more highly developed.

Cupressus nutkaënsis was discovered by Archibald Menzies in 1794, from whose specimens, collected at Nootka Sound, Vancouver's Island, it was described by Mr. Lambert in his great work, *The Genus Pinus.* It was introduced to European gardens by the late Dr. Fischer, of St. Petersburgh, under the name of *Thuiopsis borealis*, the name by which it is still generally known among horticulturists. It is essentially a northern tree, and one of the hardiest as well as one of the handsomest of Cypresses. It thrives in any ordinary soil, not too dry, and it is one of the best of Conifers for lawns and for small gardens where the larger kinds are inadmissable.

Cupressus nutkaënsis is the "yellow Cypress of the colonists in Vancouver's Island and British Columbia. The wood is whitish, but in its fresh state it is yellow. In quality it is light, tough, durable, easily worked, and has a pleasant fragrance; it is very indestructible in the ground, and on that account, is used for stakes, pickets, &c., and by the Indians of the north-west Territory it is manufactured into articles for domestic use, hunting, fishing, &c."*

Cupressus sempervirens.—The evergreen Cypress, of which two forms are common in the south of Europe and Asia Minor, but only one is generally planted in England. This is the fastigiate or upright kind, a tall tapering flame-shaped tree, with erect branches, growing close to the trunk, and with frond-like branchlets covered with smooth imbricated yellowish-green leaves. The cones or strobiles are about an inch in diameter, and are generally produced in pairs.

Habitat.—The Mediterranean region, especially the Levant and the Greek Archipelago; also westwards as far as the Himalayas.

Introduced into England prior to 1548, in which year it is mentioned by Turner in his "*Names of Herbes.*"

Cupressus sempervirens horizontalis has its branches spreading instead of erect, but differs in no other essential character from the upright kind.

The two forms above described are analogous to two similar forms

* Mr. Robert Brown in the *Gardeners' Chronicle.*

in cultivation of the Californian *Cupressus macrocarpa*. M. Carrière is of opinion that the spreading form is the type, and the upright kind only a variety.* As in the case of *C. macrocarpa*, the two extremes are connected by intermediate forms, in which the gradations from one to the other are plainly perceptible.

Many varieties of *Cupressus sempervirens* have been noticed, and some of them described as distinct species; but owing to their comparative tenderness, or the slight deviation they show from one or other of two forms described above, few, if any of them, are to be seen in British gardens. It is sufficient in this place to mention one only, *C. sempervirens indica*, which is met with in Nepaul, thus proving that the common Cypress must, at one time, have had a very extensive range. The Himalayan variety differs from the European type, as cultivated in England, chiefly in having a more open head. It is the *C. Whitleyana* of Gordon's *Pinetum*.

The economic value of *Cupressus sempervirens* is not very considerable, although its wood is virtually indestructible by ordinary agents, except fire. This remarkable durability was known to the Greeks and Romans, who employed Cypress wood in the construction of various articles of household furniture, also for chests, vine props, posts, and pallisades, and especially for coffins, which were found to resist decay for ages after being buried in the earth.† It is still used for similar purposes in the south of Europe. In Great Britain the only use of *C. sempervirens* is for ornamental planting, and although it has been known over three hundred years, there are no old trees in this country owing to climatal causes. In the south of Europe, it lives to a great age, and attains a height sometimes exceeding 100 feet. There are still existing in France and Italy ancient trees of great historic interest, and others associated with illustrious names in literature and art. There are three Cypresses standing in the Garden of the Convent of the Chartreuse, at Rome, that were planted by Michael Angelo (A.D. 1474-1563); one is in a state of decay, the other two are still vigorous. The Cypress of Somma, in Lombardy, is much more ancient. Tradition refers it to the time of Julius Cæsar. "Besides its great age, it is remarkable for having been wounded by Francis I., who is said to have struck his sword into it in his despair at losing the battle of Pavia; and for having been respected by Napoleon, who, when laying down the plan for the great road over the Simplon, diverged from the straight line to avoid injuring the tree."‡ M. Carrière states that there still remains a Cypress near Montpellier over eight hundred years old, and known to the inhabitants by the name of Arbre de Montpellier. It is the only surviving tree of the forest of Cypresses that is believed to

* *Traité Général des Conifères*, p. 149.

† Loudon, *Arb. et Frut.*, p. 2473. ‡ *Idem*, p. 2471.

have once covered the ground sloping towards the south, on which part of the town is built.*

The three Cypresses of Michael Angelo are the fastigiate form; the Cypress of Somma and the Arbre de Montpellier are the horizontal variety.

Cupressus thyoides.†—A tree of variable height and of pyramidal and dense habit. The trunk is slender and tapering, sometimes attaining a height of from 50 to 70 feet in the low marshy grounds of Virginia, but much less in districts further north. The branches are spreading and much ramified, the branchlets very slender, crowded, and covered with small ovate or triangular-shaped, closely appressed glaucous green leaves, which often have a small gland at the back. The cones are small globular bodies, not much larger than peas, with thick scales, bearing two or more seeds attached to their contracted base.

Habitat.—The eastern United States, in the neighbourhood of the Atlantic coast, from Massachusetts to Florida; also in Wisconsin.

Introduced by Peter Collinson in 1736.

Cupressus thyoides Hoveyi.—A variety of rather slender habit, in which the ultimate branchlets are short, very numerous, and agglomerated into dense terminal tufts.

Cupressus thyoides leptoclada.—See *Retinospora leptoclada.*

Cupressus thyoides nana is a compact, diminutive bush, with glaucous foliage, useful for variety in collections of small Conifers, and in damp places where few other kinds will grow.

Cupressus thyoides variegata.—A handsome low or medium-sized tree, on which more than half the branchlets, with their foliage, are of a rich golden-yellow. It requires a damp, moist situation.

Cupressus thyoides is popularly known in America as the White Cedar. The wood is reddish, light, fine in grain, and very durable, and on

* Carrière, *Traité Général des Conifères*, p. 149.

† *Cupressus thyoides* is the typical tree upon which Spach founded his genus *Chamæcyparis*, and around which were subsequently grouped *C. Lawsoniana*, *C. nutkaënsis*, and the Japanese Retinosporas.

that account much used for shingle, palisades, boat-building, cooperage, &c., in the States, where it is abundant. In England its only use is as an ornamental tree, and as such it is very handsome when planted in low and damp situations, for which alone it is suitable. In dry soils its growth is very slow, and it has also a bare and unfurnished aspect.

Cupressus torulosa.—A tall fastigiate tree, with short ascending branches, much ramified at their extremities; the branchlets are slender, short, twisted, and covered with imbricated glaucous leaves. In young trees the leaves are slightly spreading, but in older ones they are appressed to the stem, and are thin, minute, very smooth, and closely imbricated in four rows. The strobiles or cones are somewhat smaller than those of the European Cypress.

Habitat.—The north-western Himalayas, at heights varying from 6,000 to 12,000 feet; generally in inaccessible situations.

Introduced by Dr. Wallich in 1824.

Cupressus torulosa cannot be called a satisfactory tree for horticultural purposes, for although it is sufficiently hardy to withstand average English winters without injury, in exceptionally severe ones large specimens, 20 to 30 feet high, have succumbed.

The specific name *torulosa*, "tufted," refers to the tufted appearance of the branchlets.

Cupressus torulosa Corneyana.—A low tree, with slender drooping branches and branchlets covered with small closely imbricated leaves, so nearly resembling those of *C. torulosa*, that, except in habit, this plant can scarcely be distinguished from the species to which we have referred it.*

This Cypress was introduced to British gardens by Messrs. Knight and Perry, our predecessors at the Royal Exotic Nursery, Chelsea, who left no account of its origin. In their *Synopsis of Coniferous Plants* (page 19), they state that it is supposed to be a native of either Japan or the north of China, a supposition that has not yet been verified.

Cupressus lusitanica.—A tree attaining a height of about 50 feet, with spreading flexuose branches and numerous incurved scattered branchlets, clothed with glaucous scale-like pointed leaves. It is popu-

* M. Carrière has also referred it to *Cupressus torulosa* for the same reason, and states that it is a native of the Himalayas, but gives no authority.—*Traité Général des Conifères*, p. 151. Mr. Gordon says, "It is found in Japan and the northern parts of China," but quotes no authority.—*Pinetum*, p. 81.

larly known as the Cedar of Goa, and is supposed to have been introduced into Portugal from Goa, on the west coast of India, but as no Gymnospermous plants are now found wild in that part of the country, there is reason for doubting its Indian origin. It has become naturalised in Portugal and some parts of Spain, from whence numerous varieties find their way into English gardens, that generally perish during the first severe winter to which they are exposed.

II.—RETINOSPORA *(Siebold)*. The Japanese Cypress.

The Retinosporas, which now constitute a rather numerous group, are trees and shrubs presenting much diversity in habit and colour of foliage. They are all referable, with two or three exceptions, to two well defined forms or species, *Retinospora obtusa* and *R. pisifera*, natives of Japan, but which, under cultivation, both in their native country and in European gardens, have sported into many distinct and beautiful varieties. Their introduction to British gardens is comparatively recent. The typical or normal kinds, together with several of the most distinct of the Japanese varieties, were brought to England by the late Mr. J. G. Veitch in 1861, and in the same year other varieties were sent to Mr. Standish, of Ascot, by Mr. Robert Fortune.

The Retinosporas are quite hardy, thriving best in a moist soil and in a situation not too exposed. The fastigiate and dwarf varieties require but little space, but *Retinospora obtusa* and *R. pisifera* attain the dimensions of large trees in Japan, and are handsome specimens for the park as well as for the lawn. The variegated and upright forms are suitable for terrace and geometric gardens; the dwarf and procumbent kinds are excellent rock plants; there is, in fact, no department of ornamental gardening in which this beautiful group of Conifers does not furnish some of the most appropriate as well as the handsomest subjects.

Retinospora * is a compound word formed from ῥητίνη (rhetinè), "resin," and σπορὰ (spŏra) "seed."

The chief characters upon which Siebold founded the genus are, that each scale of the strobile or cone bears only two seeds, and that the seeds themselves are marked with resinous blotches. But instances of the scales bearing more than two seeds are of frequent occurrence, and the seeds of *Cupressus Lawsoniana* are marked with

* Siebold has Retinispora, *Flora Japonica*, ii., p. 36.

Group of Japanese Conifers in Linton Park.

resinous blotches in the same way. Hence it is that Siebold's genus, Retinospora has not been adopted by scientific men, and the name is therefore relegated to the garden, where also it must in time give place to the more comprehensive and simpler generic designation.

In the following Synopsis, the most distinct of the varieties are given and described independently of the species to which they are generally referred, for the purpose of simplifying tedious appellatives, consisting, in some cases, of four and even of five words—*Filicoides, lycopodioides,* and *tetragona,* are forms of *obtusa; filifera, plumosa,* and *squarrosa,* are forms of *pisifera.*

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
RETINÓSPORA ERICOÌDES (*Hort.*)	*Juniperus ericoides* (Hort.) *Widdringtonia ericoïdes* (Hort.) *Retinospora juniperoides* (Carrière) *Chamæcyparis decussata* (Hort.) *Biota orientalis decussata* (Hort.) *Retinospora decussata* (Hort.)	The Heath-like Retinospora	Garden variety...	4— 5
FILICOÌDES (*Hort. Veitch*)	,, *obtusa filicoides* (Hort.)	The Fern-like Retinospora	Garden variety from Japan	
FILÌFERA (*Hort. Standish*)	,, *pisifera filifera* (Hort.)	...	,, ,,	
LEPTOCLÀDA (*Hort.*)	,, *squarrosa leptoclada* (Gordon) *Chamæcyparis squarrosa leptoclada* (Endlicher) ,, *leptoclada* (Hort.) ,, *sphæroides andelyensis* (Carrière)	The slender-branched Retinospora	Garden variety, France	8— 10
LYCOPODIOÌDES (*Hort. Standish*)	,, *obtusa lycopodioides* (Carrière) *Retinospora monstrosa* (Hort.)	The Club-moss Retinospora	Garden variety from Japan	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
RETINÓSPORA OBTÙSA (*Siebold & Zuccarini*)	*Chamæcyparis obtusa* (Endlicher) (Parlatore)	The Japanese Cypress	Japan	60— 80
,, àlbo-picta (*Hort*)	*Retinospora obtusa alba* (Hort.)	...	Garden variety...	
,, aùrea (*Hort. Veitch*)	*Chamæcyparis obtusa aurea* (Carrière)	The golden Japanese Cypress	Garden variety from Japan	
,, compàcta (*Hort.*)	... ...	...	Garden variety...	5— 6
,, gràcilis aurea (*Hort. Veitch*)	... ...	...	,, ,,	
,, nàna (*Hort.*)	,, *obtusa nana* (Carrière)	The dwarf Japanese Cypress	,, ,,	3— 5
,, pygmæa (*Gordon*)	*Thuia pygmæa* (Hort.)	...	Garden variety from Japan	1— 2
PISÌFERA (*Siebold & Zuccarini*)	*Chamæcyparis pisifera* (Endlicher) (Parlatore)	The Pea-fruited Retinospora	Japan	50— 80
,, aùrea (*Hort.*)	... ...	...	Garden variety...	
PLUMÒSA (*Hort. Veitch*)	... ...	The feathery Retinospora	Garden variety from Japan	15— 20
,, àlbo-picta (*Hort.*)	... ...	...	,, ,,	12— 15
,, argèntea (*Hort.*)	*Retinospora pisifera argentea* (Hort.)	...	,, ,,	12— 15
,, aùrea (*Hort.*)	*Retinospora pisifera aurea* (Hort.)	...	,, ,,	15— 20
SQUARRÒSA (*Siebold & Zuccarini*)	*Chamæcyparis squarrosa* (Parlatore) *Cupressus squarrosa* (Lawson)	...	Japan	10— 15
,, dùbia (*Hort.*)	*Retinospora pseudo-squarrosa* (Carrière) *Retinospora juniperoides* (Gordon)	...	,, ...	10— 15
TETRAGÒNA aurea (*Hort. Barron*)	*Retinospora filicoides aurea* (Hort.)	...	Garden variety...	

Retinospora ericoides.—A small compact shrub, generally of conical form, not exceeding 3 or 4 feet in height. The branches are very numerous, and furnished with short branchlets clothed with linear pointed leaves arranged in opposite cross pairs, and marked beneath with two glaucous lines. During the growing season the foliage is of a deep pea-green colour, which changes in autumn to a brownish-violet.

We have included this plant among the Retinosporas on account of its name having become too firmly fixed in garden nomenclature to admit of its removal by a mere stroke of the pen. Its proper place is under Biota, of which it is nothing more than a "juvenile" form, that is to say, it originated from a seedling in which the primordial leaves only are developed. Mr. Gordon's assertion that this shrub and *Retinospora leptoclada* "are cultivated in Japan, in pots, under the name of Nezu" (*Pinetum*, p. 363), is without foundation, as neither of them is known to Japanese horticulturists.

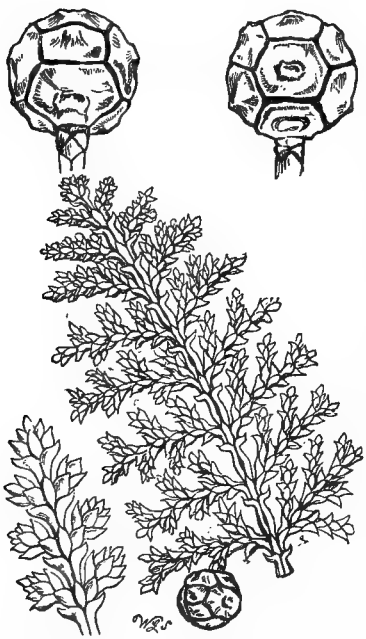


Fig. 54.—*Retinospora filicoides.* This and the four following figs. from the *Gardeners' Chronicle.*

Retinospora filicoides.—A beautiful tree, resembling in habit *R. obtusa*, of which it is a variety. The branches are thickly furnished with short fern-like branchlets, of equal size, and distichously arranged. The leaves are closely imbricated in four rows, thick in texture, and of a rich deep green colour on the upper side of the branchlets, and slightly glaucous on the under side.

Retinospora filifera.—A low tree of irregular outline, well distinguished by its thread-like pensile branchlets. "The branches are spreading, with the secondary ones alternate, long, somewhat distant, and furnished principally on one side with numerous branchlets of various lengths, the terminal ones longer, filiform, and with tufts of small spray at their points." The leaves are subulate, pointed, distant, in alternate pairs, and fulvous green in colour.

Fig. 55.—*Retinospora filifera.*

Retinospora leptoclada.—A low tree or shrub, of fastigiate or pyramidal habit, and silvery bluish-grey foliage. The branches are close-set along the stem, short, sub-erect, and much divided; branchlets flattened, fern-like, and clustered towards the extremities of the branches and their numerous sub-divisions. The leaves are of two kinds, the primoidial ones linear awl-shaped, recurved, and light glaucous green; the later ones scale-like, closely appressed to the branchlets, and deeper in colour.

The shrub cultivated in this country under the name of *Retinospora leptoclada* originated many years ago in the Nursery of M. Canchois, at Andelys, in France. It appeared among a batch of seedlings of *Cupressus thyoides*, and the proprietor finding it of very different habit and aspect from the others, propagated it by cuttings, and subsequently exhibited young plants of it at Paris, under the name of *Chamæcyparis sphæroidea Andelyensis*. The stock passed into the hands of Messrs. E. G. Henderson & Son, of London, by whom it was introduced to British gardens under the name it now bears. The plant described by M. Carrière, under the name of *R. leptoclada*, and which he affirms to be distinct from the Andelys plant,* is unknown to us. His statement that it "habite le Japon, d'où elle fut importée

* Il n'a *aucun* rapport avec la plante que la plupart des horticulteurs vendent sous ce même nom *Retinospora leptoclada.*

en 1861, par M. Veitch fils" (*Traité*, p. 139) rests on no evidence that we possess.

As a garden shrub the *Retinospora leptoclada* above described, is both useful and distinct, and may be always employed with advantage in the shrubbery and for winter bedding, a moist situation being best for it.

Retinospora lycopodioides.—A low tree or shrub, of spreading habit and irregular outline; branches rigid, spreading, and much divided; branchlets numerous, irregularly arranged on all sides of the primaries, more closely set at the extremities, where they are contorted and flattened; leaves crowded, thickened, closely imbricated around the stem, and of a deep rich green colour, which is retained through the winter.

Retinospora obtusa.—A tall tree, with straight, erect, and tapering trunk, attaining a height of from 60 to 100 feet, with a diameter of 4 feet near the ground. The branches are numerous and spreading, the lower ones decumbent by the weight of their appendages; secondary branches crowded, and produced laterally only; the branchlets flattened, frond-like; the leaves small, scale-like, imbricated in four rows, closely appressed to the stem, and light fulvous green. The strobiles or cones are about half an inch in diameter, and composed of eight or ten scales, arranged in opposite pairs, each scale having an umbo or small protuberance on the exterior surface.

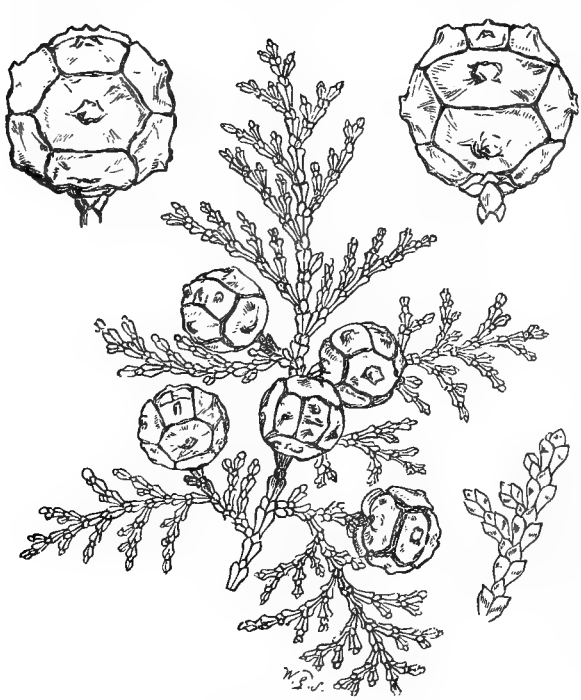


Fig. 56.—*Retinospora obtusa.*

Retinospora obtusa is one of the most useful timber trees in Japan; the wood is light, white, fine in grain, and susceptible of a high polish. The Japanese show the high estimation in which they hold this tree by selecting its wood for the construction of their shrines and temples. Retinospora timber is also much used in houses, especially for flooring; it resists decay in water and under ground for a long period, and is on that account employed for posts, piers, &c., it is also used in shipbuilding. As an ornamental tree *R. obtusa* has long been cultivated in Japan, where many beautiful and distinct varieties of it have been obtained. One of the purposes for which it is planted in that country is for the formation of avenues, in which its fine proportions are very effective. In England it should be planted only for ornamental purposes, and always in a moist retentive soil, and sheltered from the north and north-east.

Retinospora obtusa albo-picta resembles the ordinary form in habit, but differs in having many of its young shoots creamy-white, which gives the plant a speckled and spotted appearance.

Retinospora obtusa aurea is more fastigiate in habit than the type, and has the branchlets and foliage of a deep golden-yellow, which is highly developed during the growing season. It is one of the most remarkable coloured Conifers in cultivation.

Retinospora obtusa compacta.—A robust dwarf form, with the stem much divided at the base, and the branches crowded and more dense than in the species. The foliage is similar in colour to that of *R. obtusa*.

Retinospora obtusa gracilis aurea.—A beautiful tree, of pyramidal habit. The branches are spreading and elongated at their extremities into slender sub-pendulous stems furnished with short branchlets, which with their foliage when first formed, are of a light clear yellow, but change to light green when mature. It is one of the most graceful and attractive of all the varieties of *R. obtusa*.

Retinospora obtusa nana does not form a tapering trunk like the species, but has its stem much divided and sub-divided near the ground into numerous erect and sub-erect slender branches.

Retinospora obtusa pygmæa.—A singular little bush, rarely

exceeding 1 foot high. It spreads horizontally on all sides, but not upwards, and forms a dense tuft of green spray, as ornamental as it is curious. It is one of the best dwarf Conifers for rock-work and small gardens.

Retinospora pisifera is easily distinguished from *R. obtusa* by the feathery appearance of its foliage. The trunk is erect and furnished with spreading branches, here and there one projecting beyond its nearest neighbours, the general outline of the tree being

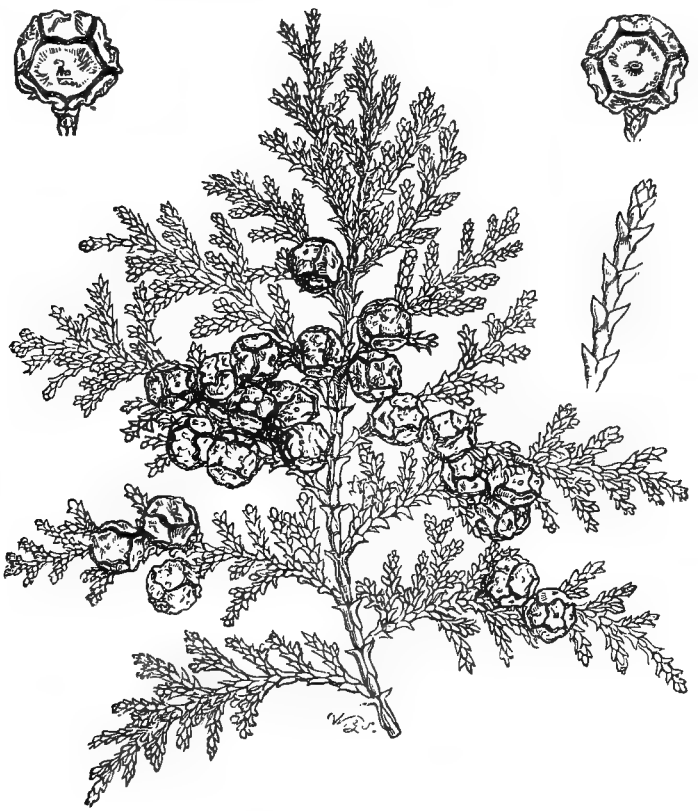


Fig. 57.—*Retinospora pisifera.*

pyramidal without being formal. The branchlets are slender, and the scale-like leaves distinctly four rowed, but somewhat distant, more pointed and less closely appressed than in *R. obtusa;* in colour they are light fulvous green above and marked with two glaucous lines

beneath. The strobiles or cones are about the size of small peas, which suggested the specific name—pea bearing.

The timber of *Retinospora pisifera* is like that of *R. obtusa*, and is used for similar purposes.

Retinospora pisifera is the common Cypress of Japan; it occurs more frequently and in greater abundance in a wild state, and it is also spread over a greater area than *R. obtusa*.

Retinospora pisifera aurea has the whole of its foliage and young growth of a rich golden-yellow. It is a very pretty variety, quite distinct from *R. plumosa aurea* described below.

It originated in the Nursery of Messrs. Barron & Son, at Borrowash, near Derby.

Retinospora plumosa.—A dense tree, of conical habit, distinguished by the following characters:—The branches are numerous, sub-erect, and thickly furnished with lateral shoots; the branchlets close set, slender, incurved, and with their foliage of a deep green colour; and the leaves subulate or awl-shaped, sub-erect or spreading, and much pointed.

Fig. 58.—*Retinospora plumosa.*

Retinospora plumosa and its varieties are of moderate growth; their short feathery branchlets and the rich colour of their foliage render them beautiful plants for garden decoration; they are among the best of Conifers for geometric and formal gardens, and also for winter and permanent bedding.

Retinospora plumosa albo-picta.—A variety of the preceding, in

which the tips of many of the branchlets are pure white, giving the whole plant a speckled and spotted appearance.

Retinospora plumosa argentea has nearly the whole of its young growth creamy-white, which becomes green on attaining maturity, but not before it is succeeded by the white growth of the following season.

Retinospora plumosa aurea has its terminal shoots and foliage when first formed, of light golden-yellow, which gradually subsides to deep green as the season advances, and till it is succeeded in the following season by a renewal of the yellow growth. It is a very distinct variety.

Fig. 59.—*Retinospora squarrosa*. Grown at Linton Park.

Retinospora squarrosa. — A low tree, sometimes taking the form of a large dense bush with a well defined outline. The trunk is usually much divided and forked, the divisions being furnished with numerous branches; the branchlets are also numerous and spreading, and with their foliage of a light glaucous green, suffused with a tint of almost silvery whiteness, quite unlike that of any other Coniferous tree; the leaves are short, needle-shaped, and slightly bent towards the branchlets, upon which they are arranged in alternate opposite pairs.

Retinospora squarrosa is described by Siebold as a species which is said to grow wild (*sponte nascens dicitur*), on Sukejama in the island

of Kiusiu (*Fl. Jap.*, ii., p. 41). The figures and description which he gives of the fructification are, however, so nearly identical with those of *R. pisifera* as to raise doubts as its being specifically distinct. Moreover, we have seen plants of *R. squarrosa* with branches having *R. pisifera* foliage, thereby unmistakeably indicating its real affinity. It is, in fact, a variety of *R. pisifera*, in which the primordial or acicular foliage only is developed. We have analogous forms in *R. ericoides*, *Biota meldensis*, *Cupressus funebris* in its young state, and others.

Retinospora squarrosa dubia.—A small compact bush, with glaucous light green foliage. The leaves are generally larger and more erect than those of the preceding; the secondary branches less furnished with spray and the branchlets more rigid.

Like the preceding, it is most probably a "juvenile" form of *Retinospora pisifera*.

Retinospora tetragona aurea.—A dwarf slow-growing plant, "with horizontal branches, tufted at their extremities with short undivided tetragonal branchlets, clothed with short scale-like leaves, of bright golden-yellow, deepening in the second year to dark green." It is a useful plant for the rock garden.

It originated in the Nursery of Messrs. Barron & Sons, at Borrowash, near Derby.

III.—BIOTA *(Endlicher)*. The Chinese Arbor Vitæ.

Biota includes but one recognised species, from which, under cultivation, a great number of varieties have been obtained, differing from the normal form, chiefly in habit and colour of foliage, but all having the following common characters:—

The trunk is usually much divided, the branches numerous, and turned upwards, the ultimate branches much ramified, frond-like, erect, and parallel to each other.

The leaves are small, scale-like in opposite pairs, imbricated, and closely appressed to the stem; the cones or strobiles are composed of from six to eight peltate scales, each with a spiny projection, and bearing two wingless seeds.

It is upon the last-named character chiefly that the generic distinction

of Biota rests; in Thuia the seeds are winged. The generic separation of the Chinese from the American Arbor Vitæ by Endlicher, although adopted by Parlatore and others, has not generally found acceptance. By Mr. Bentham and Sir J. D. Hooker both are referred to Thuia (Thuya).—*Gen. Pl.*, vol. iii., par. 1, p. 427.

The Biota is a native of China and Japan, where it has also been long cultivated as an ornamental shrub, and where many interesting varieties have been raised, some of which have been introduced to British gardens. The common form was first brought to Europe about the middle of the eighteenth century, by French missionaries; it has been in cultivation in England since 1752.

Biota from *βιοτὴ* (biotè), meaning "living" or "mode of life," a lengthened form of *βίος* (bios), "life," in allusion to the evergreen character of the plant.

The following Synoptic Table includes the most distinct forms of European and Japanese origin.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
BIÒTA ORIENTÀLIS (*Don*)	*Thuia orientalis* (Linnæus)	The Chinese Arbor Vitæ	China and Japan	18— 25
,, argèntea (*Hort.*)	,, *argentea* (Hort.)	...	Garden variety...	15— 18
,, aùrea (*Hort.*)	,, *aurea* (Hort.) ,, *compacta aurea* (Hort.)	The golden Chinese Arbor Vitæ	,, ,,	5— 6
,, aùreo-variegata (*Hort.*)	,, *variegata* (Hort.)	The variegated Chinese Arbor Vitæ	,, ,,	15— 18
,, decussàta (*Hort.*)	See *Retinospora ericoides*			
,, elegantissima (*Hort. Rollisson*)	*Thuia elegantissima* (Hort.)	...	,, ,,	5— 6
,, falcàta (*Lindley*)	,, *falcata* (Hort.) *Biota falcata* (Hort.)	...	,, ,,	6— 8
,, japònica (*Siebold*)	,, *orientalis Sieboldi* (Endlicher) ,, *japonica* (Hort.)	...	Japan	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet
BIÒTA orientàlis meldènsis (*Hort.*)	*Biota meldensis* (Hort.) *Thuia meldensis* (Hort.) *Retinospora meldensis* (Hort.)	...	Garden variety	
,, pèndula (*Parlatore*)	*Biota pendula* (Lambert) ,, *filiformis* (Loddiges)	...	,, ,,	
,, semper-aurèscens (*Hort.*)	... ...	...	,, ,,	
,, Zuccarini-ana (*Hort.*)	... ...	...	,, ,,	

Biota orientalis.—A low tree or shrub of pyramidal, but very frequently of columnar habit, attaining a height of from 18 to 25 feet in its native country, and seldom more in Europe under cultivation. It is easily distinguished from the American Arbor Vitæ by its denser habit and foliage of brighter green. It is one of the commonest and most useful of garden shrubs.

Biota orientalis argentea differs from the common form in having many of its branchlets creamy-white. The variegation is rather inconstant, and not unfrequently disappears altogether in a few years.

Biota orientalis aurea.—A dwarf, dense, globose shrub, having its first growth in early spring, of a rich golden-yellow, which gradually changes by age to the bright green of the species.

This valuable variety originated in the Nursery of Mr. Waterer, at Knap Hill. It is generally known under the name of *Thuia aurea*, and is one of the most ornamental and popular of all the varieties of *Biota orientalis*.

Biota orientalis aureo-variegata has about one-half of its branchlets and foliage light yellow. It resembles the common form in habit, and is quite distinct from the preceding.

It originated in the Nursery of M. Dauvesse, at Orléans, in France.

Biota orientalis elegantissima.—A dwarf variety, of fastigiate habit; the branchlets are somewhat more rigid than in the usual type, and the foliage is of fine golden-yellow, which colour it retains through the summer months.

This variety originated in the Nursery of Messrs. Rollisson, at Tooting.

Biota orientalis falcata.—A variety of dense conical habit, from 10 to 12 feet high, producing large green cones or strobiles, having the spine at the end of the scales turned backwards like a small sickle.

It was introduced by Mr. J. G. Veitch from Yokohama, in Japan.

Biota orientalis japonica.—A variety of very distinct habit. The lower branches are spreading, and the tree assumes a bold globose form; the diameter of the spread of branches at the base is nearly as much as half the height of the tree, which at top tapers off abruptly. The scale-like leaves are pointed and less closely appressed to the stem than in the common form.

Biota orientalis meldensis.—A low pyramidal tree with ascending branches, often so flexible as to bend in any direction, by which the plant acquires an irregular awkward habit. The leaves are subulate, short, pointed, slightly inclined towards the stem, and light bluish glaucous green, which changes to a deeper shade, with a reddish-brown tint in winter.

Biota orientalis meldensis is a "juvenile" form in which the leaves are never scale-like as in the species. According to M. Carrière,* it originated at Meaux, about the year 1853, from seed of *B. orientalis*, gathered in the cemetery of Trilbardon, near that town. It was supposed to be a hybrid between the Virginian Red Cedar and the Chinese Arbor Vitæ, because, in the cemetery in question, several trees of these two species are planted side by side. But as analogous forms of Biota and allied genera are in cultivation whose origin is known, this hypothesis is unnecessary.

Biota orientalis pendula shows a wider departure from the type than any variety yet obtained; the branches are elongated into flexible, pensile cord-like appendages, with few ramifications, and

* *Traité Général des Conifères*, p. 103.

clothed with alternate opposite pairs of subulate decurrent leaves—larger, wider apart, and less appressed than in the species.

This curious variety, long believed to be a distinct species, is now known to have originated from the common form. It was met with in cultivation in China and Japan many years ago, and forms perfectly identical were subsequently raised from seed both in England* and France.† During a visit to the Botanic Garden at Turin, in the autumn of 1860, Dr. Hooker had his attention drawn to a fine specimen of *Biota pendula*, bearing fruit in all respects like that of *B. orientalis*. On inquiry, it was proved to him that plants of *B. orientalis*, which were pointed out by the Curator of the Garden, had been raised from seeds of *B. pendula*, thus showing, beyond all doubt, that *B. orientalis* and *B. pendula* are only forms of one species.‡ As a garden plant, *B. pendula* is rather a curiosity than an ornamental subject—it casts off its lower branches at a very early age, leaving the trunk bare to a considerable part of its height.

Biota orientalis semperaurescens.—A dwarf globose shrub, resembling in habit *B. orientalis aurea*. The foliage and terminal growth are of a golden hue, which they retain throughout the season.

It originated in the Nursery of M. Lemoine, at Nancy, in France.

Biota orientalis Zuccariniana.—A dense, dwarf globose variety, with very bright green branchlets and foliage, a colour it partially retains during the winter months.

IV.—THUIA (*Tournefort*). The American Arbor Vitæ.

The Thuias are evergreen trees, sometimes attaining a considerable height, with numerous spreading or sub-erect branches, covered with smooth greyish-brown bark, and compressed branchlets distichously alternate, the ultimate ones being produced on the anterior side only, and clothed with imbricated scale-like leaves, arranged in opposite pairs; the cones or strobiles are small oval bodies, composed of from eight to ten imbricated scales in opposite pairs, of which two only are fertile, with two winged seeds at the base. The Thuias are natives of North America, and are spread

* At Messrs. Loddiges' Nursery, *Gardeners' Chronicle*, 1861, p. 575.
† Carrière, *Traité Général des Conifères*, p. 101.
‡ Communicated to the *Gardeners' Chronicle* for 1861, p. 575.

over the continent from Canada and New England to British Columbia and Oregon. One form is also found in Japan, and another is said to have been met with in eastern Siberia. The timber obtained from the large trees is valuable, and is used for many purposes by the colonists; it is remarkable for its durability and fragrance.

All the Thuias are perfectly hardy in England; they are among the most useful of Coniferæ on account of the numerous purposes for which they may be planted, and the variety of soils in which they thrive; but generally preferring in their native country, low lying, moist situations, as the banks of rivers or streams, the shore of lakes, &c., they are also found to thrive best in Great Britain under similar conditions. Under cultivation, the Thuias are polymorphous, and several distinct varieties have originated in gardens both in England and America.

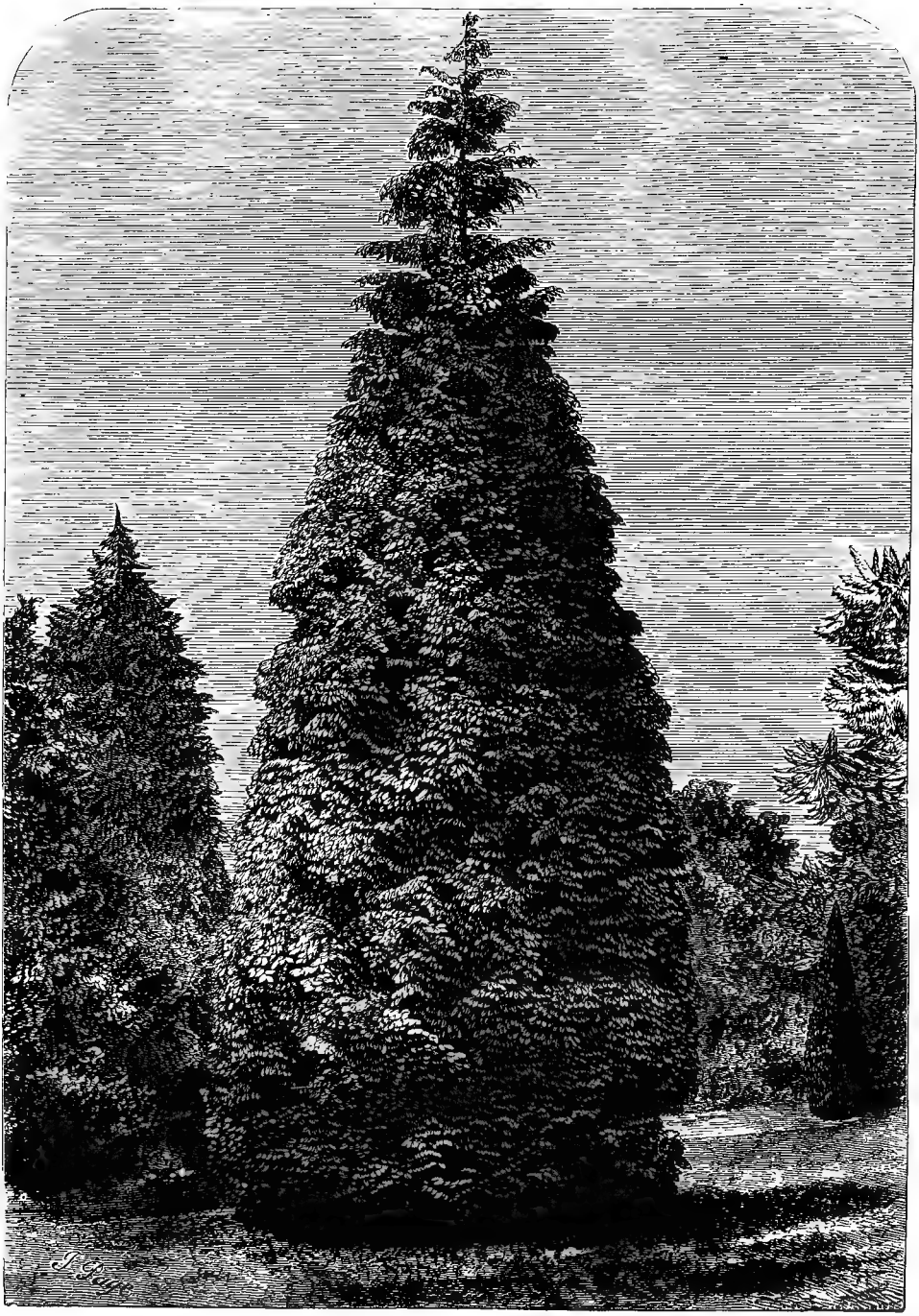
Thuia is from *θυία*, the name of a tree or shrub that cannot now be identified with certainty, whose wood, according to Theophrastus, was fragrant, and thence employed for incense in very early times. The origin of the application of the name Arbor Vitæ (Tree of Life), to the American Thuia, is unknown. It is so named by Gerard, in his *History of Plants*, published in 1597.

Thuja is the common orthography; Thuya is that of Tournefort, the founder of the genus. We have preferred the original form as being the most free from ambiguity, and which is also adopted by Carrière.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
THÙIA GIGÀNTEA (*Nuttall*)	*Thuia Menziesii* (Douglas or Carrière) ,, *Lobbi* (Hort.)	Lobb's Arbor Vitæ	N.W. America	50 to 150
OCCIDENTÀLIS (*Linnæus*)	... ...	The American Arbor Vitæ	Canada and New England States	40— 50
,, Elwangeriàna (*Hort.*)	*Retinospora Elwangeriana* (Gordon) *Thuia occidentalis ericoides* (Hort.)	...	Garden variety	
,, Hoveyi (*Hort.*)	,, *globosa* (Hort.)	...	,, ,,	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
THÙIA OCCIDENTÀLIS lutea (*Hort.*)	*Thuia* "*George Peabody*" (Hort.) ,, *elegantissima* (Hort.)	...	Garden variety	
,, pèndula (*Gordon*)	... ...	The pendulous Arbor Vitæ	,, ,,	
,, variegàta (*Hort.*)	... ...	The variegated Arbor Vitæ	,, ,,	25— 30
,, Vervaeneàna (*Hort.*)	... ...	The new Belgian Arbor Vitæ	,, ,,	
PLICÀTA (*Don*)	,, *sibirica* (Hort.) ,, *occidentalis plicata* (Loudon)	The Siberian Arbor Vitæ	N.W. America and E. Siberia	18— 20
,, dumòsa (*Gordon*)	,, *antarctica* (Hort.) ,, *minima* (Hort.) ,, *pygmæa* (Hort.)	...	...	2— 3
,, variegàta (*Hort.*)	,, *Wareana variegata* (Hort.)	...	Garden variety	18— 20
STANDÌSHII (*Gordon*)	*Thuiopsis Standishii* (Gordon) *Thuia gigantea* (Parlatore)	...	Japan ...	
WAREÀNA (*Hort.*)	,, *japonica* (Maximowicz) ,, *tartarica* (Lodiges)	Ware's Arbor Vitæ	Garden variety	40— 60
GIGANTEA (*Hort.*),	see *Libocedrus decurrens.*			

Thuja gigantea (syn. **Lobbi**).—A tall slender pyramidal tree, attaining a height of upwards of 150 feet, in the rich alluvial soil along the banks of the Columbia River, but ranging from 50 to 80 feet high in other localities. The branches are numerous, short in proportion to the height of the tree, scattered irregularly over the trunk, flexible, spreading, and frondose; the branchlets with their foliage are of a glossy bright green, a



Thuia gigantea (*Lobbi*) at Linton Park. Present height (1881) 50 feet.

colour they retain through the winter months, and by which this species is easily distinguished from *T. occidentalis*.

Habitat.—North-west America, between latitudes 45° and 55° N., and from the Rocky Mountains to the Pacific. It attains its greatest developement in the neighbourhood of the Columbia River.

Introduced by us in 1853, through our collector, William Lobb.

Thuia Lobbi is very variable, both in its native country and under cultivation. There is a collection of many varieties in the Edinburgh Botanic Garden, formed by the late curator, Mr. McNab, all showing some greater or less departure in habit or foliage from the usual type. Among the forms that have been perpetuated by horticulturists, may be mentioned an *atrovirens*, a *pumila*, a *variegata*, &c., names sufficiently indicative of the character of the varieties to which they are applied.

The economic value of *Thuia Lobbi* in its native country is considerable. "Its timber is fine grained, bright yellow, and much used for building purposes. The natives at Nootka Sound manufacture their cloaks of its inner bark, which is very pliable and soft, and is also made into mats, sails, ropes, &c. The bark, which is rather thin, is also used in covering the roofs of houses and other buildings.* In Great Britain, its chief value consists in its ornamental qualities. It is an elegant tree for the park and lawn, and especially effective, if planted in proximity to ornamental water where the soil is not water-logged; it is also one of the best Conifers for the formation of evergreen hedges.

Thuia Lobbi is described under the name of *T. gigantea* by some writers, and *T. Menziesii* by others,† while the name under which we distributed it is generally adopted by horticulturists. By Carrière and Hochstetter, the *Libocedrus decurrens* of Torrey is described under the name of *Thuia gigantea*, and by this name that tree is generally known among horticulturists in Great Britain. There is, therefore, a confusion in the nomenclature of the two species, which it is very desirable should be got rid of. It originated in this manner:—A few years previous to the introduction of *T. Lobbi* to British gardens, Nuttall, an American botanist, published his *Plants of the Rocky Mountains*. At page 52 of that work, a Thuia is described under the name of *T. gigantea*, which some refer to our *T. Lobbi*, and others ‡ to the *Libocedrus decurrens* of Torrey, discovered during the

* Sir E. Belcher, *Voyage Round the World; ex* Gordon, *Pinetum*, p. 402. But it is quite probable that *Cupressus nutkaënsis* may be the tree Sir Edward refers to, *see* p. 236.

† Carrière, *Traité Général des Conifères*, p. 107. Henkel and Hochstetter, *Nadelholzer*, p. 281. *Pinaceæ*, by Senilis, p. 67.

‡ *See* Parlatore, *Prod.* xvi., p. 457; A. Murray, in *Gardeners' Chronicle*, 1873, p. 1717; Gordon, *Pinetum*, p. 402; Hugh Fraser's *Handy Book of Conifers*, p. 151.

overland expedition to California, conducted by Colonel Fremont, in 1843 or 1844. The Libocedrus was first received in this country by the Scotch Oregon Association, through their collector, John Jeffrey, without a name, a few months earlier than *T. Lobbi* was received by us at our Exeter Nursery, from William Lobb. The Oregon Committee named Jeffrey's tree *T. Craigiana*, in compliment to Sir William Gibson Craig, one of their members, Torrey's designation being at that time unknown to the Committee,* and it was distributed among the members of the Association under that name, but Carrière's name, *T. gigantea*, became generally current in English gardens. *T. Lobbi* was not distributed till three or four years later. The late Mr. James Veitch finding a *T. gigantea* already in cultivation, and desirous of paying a well merited tribute to the exertions of Lobb, selected this beautiful Thuia to perpetuate his name.† That Lobb's name is worthy of being thus held in remembrance will be seen from the following sketch of his life and labours as a collector.

William Lobb was born in the eastern division of Cornwall, in the year 1809. The place is unknown, nor is anything known of his early life. When a young man, he applied himself to gardening, and obtained a situation as gardener to Mr. Stephen Davey, of Redruth, whose horticultural establishment appears to have been on a modest scale, but which, under Lobb's management, became thoroughly efficient. After remaining in the service of Mr. Davey a few years, Lobb entered the nursery of Mr. Veitch, at Exeter, for the purpose of improving his knowledge of plants. For a long time previous, he had cherished an ardent desire for travel and adventure; he was quick of observation, ready in resources, and practical in their application. While at Redruth and at Exeter, he had availed himself of every opportunity to remedy the defects of his education; and his numerous letters to Mr. Veitch, written in the course of his long journeyings in South America and California, abundantly testify to the success of his endeavours in that direction. He had also devoted much of his leisure time to the study of Botany, in which he acquired considerable proficiency. Mr. Veitch, finding him thus qualified, proposed that he should go on a mission to South America, for the purpose of collecting plants in that rich quarter of the globe, an offer which Lobb gladly accepted. He sailed from Plymouth in 1840, for Rio Janeiro. On his arrival in Brazil, he first proceeded to the Orgãos Mountains, where he met with several beautiful Orchids at that time extremely rare in English gardens, and other useful plants, some of them quite new, one of the most important of his

* Mr. A. Murray, in *The Garden*, vol. ii., p. 542.

† *Aërides Lobbi*, *Bolbophyllum Lobbi*, *Æschynanthus Lobbi*, *Cryptomeria Lobbi*, and *Selaginella Lobbi*, are all named after his brother Thomas, by whom they were discovered.

earliest discoveries being *Pleroma elegans*.* He afterwards went to Buenos Ayres, and then proceeded to Chili by crossing the great Pampas of the Argentine Republic and the Chilian Andes. After a brief stay at Mendoza, Santiago, and Concepcion, he reached Valparaiso. He then went southwards and penetrated the great Araucaria forests, where he collected a large quantity of seeds of *Araucaria imbricata*. At that time this tree was so scarce in England that young plants could not be obtained in nurseries. Hundreds of plants were raised from the seeds sent home by Lobb, who was thus instrumental in bringing this remarkable Conifer into general use for ornamental planting. Afterwards he proceeded northwards to Peru and Eucador, where he remained for nearly two years, exploring the country and collecting plants. He returned to England in 1844, renewed his engagement with Mr. Veitch, and sailed again for Brazil in April of the following year. After sending home from Rio Janeiro, a consignment of plants which he had collected in southern Brazil, he once more proceeded to Valparaiso, for the purpose of exploring southern Chili, at that time but little known to Europeans, except along the coast. Here a rich harvest awaited him. Among his earliest successful introductions from this region were *Lapageria rosea*,† *Escallonia macrantha*,‡ *Embothrium coccineum*,§ *Philesia buxifolia*,‖ *Desfontainea spinosa*,¶ and many other beautiful plants still foremost among garden favourites. Following up these brilliant achievements, he continued his explorations in Valdivia, Chiloe, and northern Patagonia, where he collected seeds and plants of *Libocedrus tetragona*, *Fitzroya patagonica*, *Saxe-Gothœa conspicua*, and *Podocarpus nubigenus*, "four most interesting Conifers for this country, after *Araucaria imbricata*, that South America produces."** Nor must we omit mention of *Berberis Darwinii*,†† which was first introduced to British gardens by him during the same expedition.

Lobb returned to England in 1848, not to rest upon his laurels, for his love of travel was as strong as ever, and the firm friendship that subsisted between him and Mr. Veitch remained unchanged. He, therefore, determined to continue his exploring expeditions. The wonderful Conifers discovered by Douglas in California and Oregon, were then still very scarce in England, and young plants of most of the important species could scarcely be bought with money.‡‡ Hartweg had succeeded in sending consignments of cones and seeds to the Horticultural Society of London, three years previous, but the plants raised from them were distributed among the fellows only. It was, therefore decided that Lobb should proceed to California with a view of obtaining seeds of all the most important kinds known, and to discover others, if possible. He landed at San Francisco in the

* *Bot. Mag.*, Tab. 4262. † *Idem*, 4473. ‡ *Idem*, 4447. § *Idem*, 4856.
‖ *Idem*, 4738. ¶ *Idem*, 4781. ** *Idem*, 4616. †† *Idem*, 4590.
‡‡ Loudon, *Arb. et Frut.*, pp. 2249, 2251, 2266, 2344.

summer of 1849, and at once made arrangements for exploring southern California. Lobb's experience as a collector, his indomitable perseverance and courage, which was deterred by no danger, no toil, or no privation, enabled him to surmount difficulties and accomplish enterprises during the succeeding seven years of his collecting excursions through California and Oregon, which were scarcely equalled by Douglas himself. One of the first fruits of his expedition to southern California was the successful introduction of *Abies bracteata.** During the years 1850-1, he sent home consignments of cones and seeds of *Pinus insignis*, *P. muricata*, *P. Sabiniana*, *P. macrocarpa*, *P. tuberculata;* also of many shrubs and flowering plants, some of which were quite new to British gardens. In the autumn of 1851 he extended his operations further north, and collected cones and seeds of the Redwood *(Sequoia sempervirens)*, *Pinus Lambertiana*. *P. monticola*, &c. In 1852 he made an excursion to the Columbia River and Oregon, where he succeeded in obtaining seeds of *Abies Douglasii* and *A. nobilis*, still rare at that time in England, and the beautiful Thuia named after him. Returning through north California, he collected seeds of *Abies grandis*, *A. magnifica*, which he sent home under the name of *A. amabilis*, believing it to be the *A. amabilis* of Douglas, *A. concolor (lasiocarpa)*, the first received in England of that fine Fir, *Juniperus occidentalis*, *Pinus ponderosa*, &c. In 1853 he explored the Sierra Nevada, whither he was led by the reports of the discovery of trees of extraordinary magnitude, and which he had the good fortune to find, and to secure the first cones and seeds of the Wellingtonia received in England. He brought these home at the end of the year. He also brought home with him two living plants, which were afterwards planted out in our Exeter Nursery, where they survived but three or four years.† Lobb returned to California in the autumn of 1854, and from that time up to the end of 1856 he continued to send home consignments of plants and seeds. In 1857 his engagement with Mr. Veitch terminated. He remained, however, in California, and sent collections of seeds to England from time to time. In 1863 he was seized with paralysis, and lost the use of his limbs, which probably his long journeyings in thinly populated countries, and consequent exposure to all weathers, had predisposed. He died at San Francisco in the autumn of the same year.

Lobb's labours and journeyings as a collector of new and rare plants extended over a period nearly as long again as that of any of the excellent and fearless men who have ventured their lives in similar missions; the distance he travelled, the fatigues he encountered, and

* *Bot. Mag.*, Tab. 4740. It is a remarkable fact that no seeds of *Abies bracteata* were received in England alive till more than twenty-five years afterwards.

† The statement of a correspondent in the *Journal of Horticulture* for January 25th, 1877, is incorrect.

the privations he endured, doubtless exceeded theirs in a like proportion. Very many of the beautiful plants introduced by him are still, and will always continue to be, among the most deservedly admired and the most prized of garden ornaments, but not one of which worth mentioning, will perpetuate his name, or by any apparent sign keep in remembrance his great achievements. This honour has been ungraciously denied to him. It is not for us to call into question the strictness of precedence in botanical nomenclature so much insisted upon. It is enough to state the fact, but at the same time it is satisfactory to add that a more appreciative application of personal names to plants now prevails.*

Thuia occidentalis, the common or American Arbor Vitæ. A medium-sized tree, of pyramidal habit, from 40 to 50 feet in height. It has a rapidly tapering trunk furnished with branches at irregular intervals; the secondary branches are numerous and frequently drooping, and the tree is more or less dense in appearance according to the soil in which it is growing. The foliage is brownish-green, becoming browner on the approach of winter, and resuming its green tint during the growing season.

Habitat.—Canada, the New England and Middle States; "common from Pennsylvania northwards, where it forms extensive Cedar swamps; rare southwards along the Alleghanies.†"

Introduced into England prior to 1597, in which year it is mentioned by Gerard as "growing in his garden very plentifully."‡

Under the name of "Cedar," the timber of *Thuia occidentalis* is much used in Canada and the adjoining States for fencing and out-door carpentry. Mr. Rowan observes,§ "That the wood of *T. occidentalis* is most useful both to the settlers and the Indians. It grows generally in wet places and on the banks of lakes and rivers, and is by no means a sign of bad land. There are hundreds of square miles of Cedar forest in Lower Canada and New Brunswick, but, strange to say, it does not grow in Nova Scotia. It is the lightest and most durable of Canadian woods. A bridge made of it lasts for fifty years without repair, and a fence for seventy or eighty. Exposed to the air and clear

* Since writing the above we have received from our respected correspondent, Professor Sargent, of Harvard, Massachusetts, seeds of a Ribes from Vancouver's Island, labelled *Ribes Lobbi* (Gray), but figured and described in the *Botanical Magazine*, Tab. 4931, under the name of *R. subvestitum*. This is truly an *amende honorable* on the part of the distinguished American botanist, but this pretty shrub will hardly bear comparison with the noble Thuia with which British horticulturists associate Lobb's name.

† Dr. Asa Gray, *Botany of the Northern States*, p. 472.

‡ *Historie of Plants*, p. 1369.

§ *The Emigrant and Sportsman in Canada*.

of the ground, it actually wears out before it rots. The scent of the timber is delicious. I think if its wonderful durability were better known in England it would be largely imported."

The common Arbor Vitæ is useful for belts and screens, and is one of the best of Conifers for high hedges, in a moist soil, formed for protective purposes. On dry sandy land it becomes thin and unfurnished, and should, if planted at all, be only sparingly used.

Thuia occidentalis Elwangeriana.—A dwarf dense bush, with numerous sub-erect branches, slender branchlets and dimorphous foliage. In one kind the leaves are linear, acute, and spreading; in the other they are scale-like and closely imbricated in four rows like those of the species.

This variety is of American origin.

Thuia occidentalis Hoveyi.—A dwarf compact variety, resembling in habit *Biota orientalis aurea*, and having short dense branchlets, with foliage of a brighter colour than that of the common form.

This variety is also of American origin.

Thuia occidentalis lutea.—A self-coloured variety, the whole of the foliage and young growth being of a bright yellow above and orange-yellow beneath. It is of a lighter tint than the variety *Vervaeneana*.

It originated in the Nurseries of Messrs. Maxwell, of Geneva, New York, and is generally known in American gardens under the name of George Peabody's Arbor Vitæ.

Thuia occidentalis pendula.—In this variety the principal branches are recurved towards the trunk, and the branchlets are tufted at their extremities.

Thuia occidentalis variegata differs from the species only in having many of the branchlets pale yellow.

Thuia occidentalis Vervaeneana is one of the most distinct and ornamental of all the varieties of the American Arbor Vitæ. During the growing season, all the branchlets, which are more slender than in the species, are tinged with a deep golden-yellow, which changes in winter to a brownish-orange.

It originated in the Nursery of M. Vervaene, at Ghent.

Thuia plicata closely resembles the common American species. It is a smaller and more compact tree, more regularly pyramidal in outline, and with shorter branches; the branchlets are numerous and densely clothed with closely appressed leaves in opposite pairs, of a brownish-green colour. It is very hardy, and may be planted as an ornamental shrub where many other Conifers of the Cypress tribe would not thrive.

Habitat.—North-west America, in the neighbourhood of Nootka Sound.*

Introduced by Archibald Menzies in 1796.

Thuia plicata dumosa is one of the dwarfest of the Thuias. It is a dense little confused bush, seldom growing more than 2 or 3 feet high, with foliage and spray resembling in colour the preceding.

Thuia plicata variegata differs from the common form in having many of its branchlets with their foliage of a bright golden-yellow.

Thuia Standishii.—A medium-sized tree, with the habit of the common Arbor Vitæ, and resembling also in some respects the Japanese Thuiopsis; it attains a height of from 40 to 60 feet, according to situation. The branches are horizontal or ascending, irregularly disposed over the trunk, distant, and spreading; the secondaries inclined or sub-pendulous; the branchlets flat, slender, lycopod-like, and pendulous at their extremities; and the leaves closely imbricated in four rows, and of a yellowish-green colour.

Habitat.—The central mountains of Japan.

Introduced by Mr. Robert Fortune, in 1861, and named in compliment to the late Mr. John Standish, of Ascot, by whom it was first distributed.

> The *Thuia Standishii* of British gardens is derived from a cultivated form only, which is of smaller size and somewhat more dense in habit than the wild tree, which has only recently been met with in the locality named above. By Parlatore, *T. Standishii* is referred

* Parlatore (*Prod.*, xvi., p. 458), observes of *Thuia plicata*, "Species in hortis frequens sed indigenâ vix nota et melius in patria investiganda. A *T. occidentali*, cui valde affinis et cujus forte varietas hortensis, ramis secondariis ob folia marginalia navicularia et persistentia compresso-ancipitibus et fere alatis, ramulis crassioribus et longioribus strobilorumque paulo majorum squamis angustioribus præsertim videtur diversa.

to *T. gigantea* (*T. Lobbi*), *Prod.*, xvi., p. 457; but from this it differs in many points. It is a much smaller tree, the branchlets are less flattened, the leaves thicker and more obtuse; they are, moreover, marked with a gland above, and by whitish lines beneath, as in Thuiopsis. It is also deserving of notice, that while the foliage and young growth of *T. Lobbi*, in common with all the American Thuias, emit a powerful aromatic fragrance when bruised or rubbed, *T. Standishii* gives out an odour more like that of the bruised foliage of *Biota orientalis* or *Thuiopsis dolabrata*, which is anything but agreeable.

Thuia Wareana.—A low tree, of dense habit and conical outline, with short horizontal or ascending branches, having the ultimate branches clustered towards their extremities, and frequently erect and parallel as in Biota. The branchlets and foliage are of a much deeper green than either *T. plicata* or *T. occidentalis*, of the latter of which it is probably a variety.

It is a useful hardy evergreen of neater habit and better colour than the common form. It is said to have originated in the Nursery of Mr. Ware, at Coventry.

V.—THUIOPSIS (*Siebold & Zuccarini*). The Japanese Thuia.

Thuiopsis is a beautiful Japanese tree, of which there is but one species, distinguished by the following characters:—

The primary branches are verticillate, spreading, and subpendulous; the secondary ones distichous (produced laterally only); the branchlets frondose, and much divided.

The leaves are in four rows, in opposite pairs, those above and below closely appressed to the stem, the lateral ones spreading; they are coriaceous in texture, variable in form, convex, and bright green above, concave and silvery beneath.

The strobiles or cones are small sub-globose bodies, about seven-tenths of an inch in diameter, and composed of from eight to ten ligneous scales, each bearing five winged seeds.

Thuiopsis from θυία (thuia), and ὄψις (opsis) "appearance," from its resemblance to the Thuia, in which genus it is now included by Mr. Bentham and Sir J. D. Hooker (*Gen. Plant.*, vol. iii., p. 427).

Thuiopsis dolabrata at Ashridge Park, the seat of Earl Brownlow.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
THUIÒPSIS BOREALIS	see *Cupressus nutkaënsis*			
DOLABRÀTA (*Siebold & Zuccarini*)	*Thuia dolabrata* (Thunberg)	The Japanese Thuia	Japan	40— 50
,, lætevirens (*Lindley*)	*Thuiopsis dolabrata nana* (Hort.)	The dwarf Japanese Thuia	Garden variety, from Japan	
,, variegàta (*Fortune*)	... ...	The variegated Japanese Thuia	,, ,,	

Thuiopsis dolabrata.—A beautiful pyramidal tree, varying in size according to the situation in which it is growing. "In a young state, until it attains the height of from 15 to 18 feet, nothing handsomer can be conceived; the branches assume a pendulous habit, the lower ones trailing on the ground; when it becomes a tree from 40 to 50 feet, its symmetry and beauty are much diminished, the lower branches die off, leaving but a mere tuft at top. It appears to prefer shady moist situations, the foliage being more luxuriant than when exposed to the sun."

The habit and aspect of *Thuiopsis dolabrata* vary very considerably. On the mountain slopes in central Japan, at from 6,000 to 8,000 feet elevation, it is a straggling shrub, 8 to 10 feet high, forming an undergrowth to *Abies Veitchii* and *A. Mariesii*, and not unfrequently mixed with Rhododendrons and dwarf Maples. Lower down, and in the plains, it takes an arborescent form with stouter branchlets and leaves.

Thuiopsis dolabrata was first made known to Europeans by Thunberg, in 1784. The first living plant received in England was sent to our Exeter Nursery by Mr. Thomas Lobb, in 1853, from the Botanic Garden at Buitenzorg, in Java; this plant arrived in a weakly condition, and all efforts to save it proved fruitless. In 1855, a plant was received at the Botanic Garden at Leyden, from Dr. Siebold,* but it was not till 1861, when Mr. J. G. Veitch, and later in the same year, Mr. Robert Fortune, sent plants and seeds to the Chelsea and Ascot Nurseries respectively, that this fine Conifer became generally distributed. As an ornamental tree for British gardens, it takes a high rank; its growth is at first rather slow, but when established in a good moist loamy soil, and protected from piercing winds, its

* *Gardeners' Chronicle*, 1855, p. 241.

progress is satisfactory; under such circumstances, it is one of the finest of lawn trees.

The specific name *dolabrata*, "shaped like a hatchet," refers to the peculiar form of the leaves.

Thuiopsis dolabrata lætevirens.—A dwarf compact variety, with slender much divided branches; the leaves are smaller and of a lighter green than those of the species, which suggested to Dr. Lindley its designation "the cheerful green Thuiopsis."

Introduced by Mr. J. G. Veitch in 1861.

Thuiopsis dolabrata variegata.—A picturesque variety, resembling the species in habit, but differing from it in having the tips of the branchlets pale yellow or cream colour.

Introduced by Mr. Fortune in 1861.

VI.—LIBOCEDRUS (*Endlicher*). The Incense Cedar.

Libocedrus includes a small group of handsome evergreen trees of Thuia-like aspect, natives of southern Chili and New Zealand. To these is now added a Californian species generally known among horticulturists as *Thuia gigantea*. The Libocedri are tall trees, of pyramidal or columnar habit, with horizontal or spreading branches, and frondose branchlets, compressed or tetragonal, clothed with scale-like imbricated leaves arranged in opposite pairs, and having long decurrent basis, the last-named character being chiefly that on which the genus has been separated from Thuia. The cones are small, ovoid, composed of a whorl of four (seldom six) scales in opposite pairs, of which one pair only are fertile, each scale bearing two winged seeds. The wood is white or yellowish, compact, fine in grain, and very durable;* the timber afforded by the Chilian species is especially valuable in that country for constructive purposes.

Libocedrus, from λιβανος (libanos), the name of a tree from which the ancients obtained frankincense, but which has not been satisfactorily identified by modern botanists, and κέδρος (kedros), "the Cedar." The name has reference to the fragrance of the wood.

* *Prod.*, xvi., p. 464.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
LIBOCÈDRUS CHILÈNSIS (*Endlicher*)	*Thuia cuneata* (Dombey) ,, *chilensis* (Don)	The Chilian Arbor Vitæ	Chili	50 to 60
DECÙRRENS (*Torrey*)	,, *gigantea* (Carrière) ,, *Craigiana* (Balfour) *Calocedrus californica* (Kurz)	The Californian White Cedar	California ...	120—140
DONIÀNA (*Endlicher*)	*Thuia Doniana* (Hooker) *Dacrydium plumosum* (Don)	Don's Arbor Vitæ	New Zealand ...	60—100
TETRAGÒNA (*Endlicher*)	*Thuia tetragona* (Hooker)	The Alerze	Patagonia and Chili	40— 80

Libocedrus chilensis.—A medium-sized tree of from 50 to 60 feet high, of pyramidal form, sometimes branched from the base, but often with the lower part of the trunk denuded of branches, and with a conical top.* In England, the young trees are symmetrical and well distinguished by their bright glaucous green foliage, and by the silvery line on the under side of the small pointed leaves.

Habitat.—Southern Chili, common on the slopes of the lower Cordilleras of the Andes, from latitude 34° S. to Valdivia.

Introduced in 1847 by Messrs. Hugh Low & Co., of Clapton.†

As a timber tree *Libocedrus chilensis* is much valued in its native country; its wood is soft and easy to work, but the planks are only used for indoor carpentry.‡ As an ornamental tree in this country it is one of the most beautiful and distinct; but it is not very hardy, and even when planted in a sheltered situation, rarely escapes injury in severe weather.

Libocedrus decurrens.—A noble tree of large dimensions, attain-

* Arbol bastante alta . . . desnudo en la basse, con los ramos tanto mas cortos que se acercan mas de la parte superior, lo que la da una forma piramidal.—Claudio Gay, *Historia de Chili*, v., p. 406.

† *Gardeners' Chronicle*, 1850, p. 439.

‡ Su madera es docil y soave para trabajar, pero solo se hace con ella cuartones que sirven para trabajo interior de las casas.—C. Gay, *Idem*, p. 407.

ing a height of from 120 to 140 feet, with a trunk 6 to 7 feet in diameter near the base, and free of branches for 70 to 80 feet of its height.* The general form is conical, the trunk tapering, the branches horizontal, with the extremities ascending; the branchlets frondose, much divided, somewhat rigid, and with the foliage deep bright green. In England the young trees are of columnar habit, more or less dense, according to the soil in which they are growing, and well distinguished by the rich colouring of their foliage.

Habitat.—North California and Oregon; abundant about McCumbers in north California, where it attains its greatest developement.

Introduced into Great Britain by the Scotch Oregon Association in 1853, by their collector, John Jeffrey.

According to Dr. Newberry the wood of *Libocedrus decurrens* is of similar character and of about equal economic value as that of *Thuia occidentalis*. As an ornamental tree for the park and lawn *L. decurrens* is one of the best of its tribe. It is quite hardy, requires but little room, and on account of its very effective aspect, it should have a place in the most select collections.

Libocedrus Doniana.—A tree from 60 to 100 feet high, with spreading tortuous branches, and flattened fern-like branchlets; the foliage more resembles that of *L. chilensis* than any other species, but may be distinguished from it by the leaves being more closely set along the branchlets, the lateral ones stouter and less pointed, and by the absence of the silvery line on the under side.

Habitat.—New Zealand, Northern Island, also on the mountain slopes in the neighbourhood of Nelson, at 6,000 feet of elevation.

Introduced about the year 1848.

Libocedrus Doniana should only be planted in sheltered situations, even in the south of England and Ireland. In its young state, it is a beautiful conservatory plant.

Libocedrus tetragona.—A tree or shrub of variable form, according to the conditions under which it is growing. On the lower slopes and in the ravines of the Andes of Valdivia, it is a beautiful pyramidal tree ranging from 40 to 80 feet high; near the snow line on the Chilian Andes, as well as at its southern limits, the Straits of Magellan, it is so diminished in size as to

* A. Murray, in *The Garden*, vol. ii., p. 542.

be only a confused scrubby bush, over which a man can step. On the larger trees, the branches are stout and spreading, with their extremities ascending; the branchlets alternate distichous, four-angled, and clothed with leaves broadly decurrent and adnate at the base, pointed and free at the apex, and of a bright grass-green colour.

Habitat.—Valdivia, in southern Chili, the island of Chiloe,* and the Andes of Patagonia, as far as the Straits of Magellan.†

Introduced by us in 1849, through William Lobb.

Libocedrus tetragona is the Alerze of the Chilians, by whom it is justly valued as one of the most important timber trees of their country. The wood is almost indestructible by the weather, boards and shingle that have been exposed for upwards of one hundred years being worn quite thin but remaining perfectly sound. It is reddish in colour, soft, easy to work, and useful for every description of carpentry. Alerze timber is exported in considerable quantities from Valdivia and Chiloe to the various ports along the Pacific coast of South America. From the thready inner bark is obtained a kind of tow, imperishable in water, which is much used by the sea-faring people of Chiloe and the adjacent coast, for making the joints of their skiffs and small craft water-tight.‡ *L. tetragona* has, up to the present time, generally failed in England, and has now become quite rare.

VII.—FITZROYA *(Sir J. D. Hooker).* The Patagonian Cypress.

Fitzroya is a sub-antarctic Conifer, taking the form of a large tree or low shrub according to the situation in which it is growing, and having the following among its most obvious characters:—

The branchlets are flexible and sub-pendulous, the leaves in whorls of fours, but sometimes in threes and twos, decurrent, "keeled beneath and on each side, the keel or midrib having a pale glaucous depressed line." The flowers are dicœcious, and produced at the extremities of the branchlets, and the cones are composed of small scales, two or three only of which are fertile, each producing two or three seeds.

By Sir W. Hooker, Fitzroya was considered to be nearest allied to the Japanese Thuiopsis, but Parlatore places it next to Diselma, a

* Claudio Gay, *Historia del Chile*, v., p. 408. † *Prod.*, xvi., p. 455.

‡ De la corteza filamentoza se obtiene una estopa incorruptibile dentro del agua, y que la gente del pais utiliza con mucha ventaja para tapar las junturas de sus Piraguas. C. Gay, v., p. 408.

rare and remarkable dicœcious Conifer, also including but a single species found in Tasmania. By Bentham and Hooker the Diselma is now referred to Fitzroya as a second species.

The genus is named in compliment to Captain FitzRoy, by whom it was first discovered, when in command of H.M. surveying ship "Beagle." *

Scientific Name.	Popular Name.	Habitat.	Height. in Feet.
FITZRÒYA PATAGÒNICA (*Sir J. D. Hooker*)	The Patagonian Cypress	Western Patagonia	Variable

Fitzroya patagonica.—A fine tree, of from 50 to 80 feet high, on the rocky precipices of the Andes below the snow line; at the snow line it dwindles to a mere bush. At its southern limits in the neighbourhood of the Straits of Magellan, it also dwindles to a scrubby bush of small dimensions. In England, like the *Libocedrus tetragona*, with which it is frequently associated in its native country, it has failed thus far to adapt itself to the climate; it makes no permanent leader, or rather it forms a multiplicity of leaders, none of which grow more than an inch or two in the course of a single season; the branches are irregular, and the habit unsymmetrical.

Introduced by us in 1849, through William Lobb.

Nothing is known of the economic value of the timber of the Fitzroya; it has probably not yet been much employed for constructive purposes, owing to the inacessibility of the places where it attains its finest developement.† As an ornamental tree in this country, its character is sufficiently stated in the above description. It is worthy of notice that the young plants of Fitzroya growing in Great Britain bear female cones in great abundance, but which produce no seed; no pollen bearing plants have yet been observed. They have also spreading leaves, while the adult trees in their native country have the leaves closely imbricated and appressed like those of a Thuia.

* The voyage of the "Beagle" will be ever memorable in the annals of science. The vessel was despatched by the British Government in 1831, to survey accurately the southernmost points of South America. Mr. Charles Darwin was invited to accompany the expedition as Naturalist, an invitation which he accepted. The "Beagle" returned to England in 1836.

† A section of a plank of Fitzroya, brought home by William Lobb, and preserved in the Museum of the Royal Exotic Nursery, shows that the wood is of a reddish colour, straight, and fine in grain, and susceptible of a high polish. The section contains 260 cubic inches, and weighs 85 ounces, or about 3 c. in. to the oz. A similar section of a plank of the Alerze (*Libocedrus tetragona*) of precisely the same size, is found to be of the same weight.

VIII.—JUNIPERUS *(Linnæus)*. The Juniper.

The Junipers are medium-sized or low trees, of fastigiate or columnar habit, and bushy shrubs, occasionally quite prostrate, inhabiting all parts of the Northern Hemisphere, from the Arctic regions to the Tropic, being most abundant in the temperate regions of Europe and North America. Unlike most of the members of the Cypress Tribe, the branches of the Junipers are not frondose, but the secondary branches are produced on all sides of the primaries, and generally at a very acute angle to them. The foliage is dimorphous, consisting either of small prickly acicular leaves in whorls of threes, or of scale-like leaves, imbricated in four rows, as in Cypress, Thuia, &c. Often both kinds are seen on the same plant at different stages of its growth. The Junipers are dicœcious, but exceptions are sometimes met with, and in such cases the staminate and ovule bearing catkins are borne on different branches. Dr. Lindley remarks, that "the distinguishing character of the Junipers consists in the female fructification being succulent, consolidated, and reduced in the number of its parts below what is usual in the Order to which the genus belongs." Like other Coniferæ, the fruit is composed of scales representing carpels spread open, and collected in a spiral manner round a common axis. But they are not more than six in number, generally three, and when ripe, are fleshy and consolidated into a body resembling a drupe; in the language of the pharmacopeia, they are berries, in that of the botanists they are termed *galbuli*.* They vary a little in colour in the different species, being in some a deep purple, in others, black, red, or reddish-brown; they differ also in size, from that of a sloe to a small

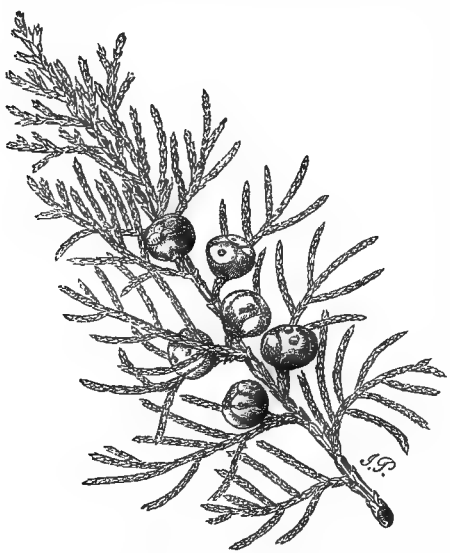


Fig. 60.—Fertile branchlet of *Juniperus thurifera*.

* *Eng. Cyclopœdia*, iii., p. 310.

pea. The resinous odour common throughout the Junipers is more concentrated in the galbuli than in any other part of the tree.

The economic properties of the Junipers are not very numerous, and they are restricted to a few of the species, and applied to still fewer purposes. The wood is light, fragrant, and of a reddish-brown colour, and that of one or two American species (*Juniperus Virginiana* and *J. Bermudiana*) sufficiently close grained to be employed in the manufacture of "Cedar pencils." The berries of the Savin are used as a diuretic in medicine; and those of the common Juniper in large quantities for flavouring gin.

As the species and varieties are numerous, and show considerable differences in some of their characteristics, the Junipers may be divided into sections, chiefly in reference to the form of the leaves and fruit; each section also possesses tolerably well marked characters in habit and aspect, and the division of the genus, therefore, is not without its advantage in the practical operations of planting. The sections are three:—

I.—*Oxycedri*, in which the leaves are generally in threes, acicular or subulate, sharp pointed, glaucous above, green beneath; berries ovate-globular, of various colours, purple predominating. The hardy species in this section are all bushy shrubs or low trees, rarely exceeding 20 feet in height. The common Juniper (*Juniper communis*), may be conveniently taken as the type of this section.

II.—*Sabinicæ*, in which the leaves are generally closely appressed to the stem, variable in form, but in most species very small, scaly, and imbricated. Berries small, globular, or egg-shaped. Many of the kinds in this section are dwarf or prostrate shrubs, of these the common Savin (*Juniper Sabina*) will serve as the type. Others are low trees, with the Savin type of foliage or some modification of it.

III.—*Cupressoideæ*. In this section some of the characters of each of the preceding are combined. The foliage is frequently dimorphous, the acicular form prevailing in the young plants, which is gradually succeeded by the scale-like form as it increases in age; berries elongated, egg-shaped, or globular, either quite smooth or covered with a glaucous bloom. All the kinds in this section useful for British gardens are Cypress-like trees, and of these the Chinese Juniper (*Juniperus chinensis*) may be taken as the type.

Juniperus, the Latin name of the Juniper, which appears to have been applied indiscriminately to any of the species common in southern and central Europe.

Section I.—Leaves acicular, generally in whorls of three, on the adult plant spreading.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNIPERUS CANADÈNSIS (*Loddiges*)	*Juniperus communis canadensis* (Loudon)	The Canadian Juniper	Canada	2 to 5
COMMÙNIS (*Linnæus*)	*Juniperus vulgaris* (Bauhin)	The Common Juniper	Northern Europe and Asia, as far south as the Himalayas	12— 15
,, comprèssa (*Carrière*)	,, *compressa* (Rinz)	...	Pyrenees ...	1— 3
,, cracòvia (*Loddiges*)	... ...	The Cracow or Polish Juniper	Poland	12— 15
,, hibèrnica (*Loddiges*)	*Juniperus stricta* (Hort.) ,, *hibernica* (Loddiges)	The Irish Juniper	Ireland (?) ...	15— 20
,, nàna (*Loudon*)	,, *alpina* (Gaudichaud) ,, *minor montana* (Bauhin) ,, *sibirica* (Hort.)	The dwarf or Alpine Juniper	Europe and Northern Asia	1—
,, oblònga (*Loudon*)	,, *oblongata* (Hort.) ,, *interrupta* (Hort.)	The Caucasian Juniper	The Caucasus ...	2— 5
,, suècica (*Loudon*)	,, *suecica* (Hort.) ,, *fastigiata* (Knight)	The Swedish Juniper	Sweden	10— 12
DRUPÀCEA (*Labillardiere*)	*Arceuthos drupacea* (Antoine) *Juniperus latifolia arborea* (Tournefort)	The Arceuthos or the Syrian Juniper	Asia Minor ...	20— 25
HEMISPHÆRICA (*Presl*)	*Juniperus echinoformis* (Rinz) ,, *communis hemisphærica* (Parlatore)	The hedgehog Juniper	South of Europe (Alpine)	1—

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNĪPERUS MACROCÀRPA (*Sibthorp*)	*Juniperus umbilicata* (Grenier) ,, *sphærocarpa* (Antoine) ,, *Lobelli* (Gussoni)	The large-fruited Juniper	Central Europe	10— 12
NEABORIÈNSIS (*Lawson*)	,, *sphærocarpa* (Antoine)	...	Garden variety...	10— 12
OXYCÈDRUS (*Linnæus*)	,, *rufescens* (Link)	The prickly Cedar	South of Europe	10— 12
RĪGIDA (*Siebold*)	... ...	The stiff-leaved Juniper	Japan	15— 20

Juniperus canadensis.—A dwarf spreading bush of inelegant habit, seldom exceeding a yard in height, found in Canada, Labrador, and the territory around Hudson's Bay, where it may be regarded as the representative of the common European Juniper, which it much resembles, especially the Alpine form (*J. communis nana*), "but it is easily distinguished from it by its much narrower, sharper pointed, and paler foliage, and by the silvery band on the upper surface." *

It is a useful plant for the rock garden, but is frequently much infested with red spider.

Juniperus communis.—The common Juniper of Britain and the Europeo-Siberian region, over which it is spread, from Norway to Kamtchatka. As a species, it varies exceedingly according to the latitude and the elevation at which it is found. In valleys and lowlands it attains the dimensions of a tree 20 feet high; on mountain slopes and on exposed hill sides, it is a dense shrub from 3 to 5 feet high; and at the highest elevations and in the highest latitudes at which it occurs, it is a procumbent bush rising but a few inches above the ground. In Great Britain "it is a common bush, with long, narrow, sharp-pointed leaves, which are concave and glaucous on the upper side, but convex and

* Gordon, *Pinetum*, p. 129.

green on the under. The fruit is used in considerable quantities on the Continent in the preparation of gin, and in medicine it is a powerful diuretic." *

The common Juniper is not unfrequent in a wild state in England, notably on the North Downs in Surrey, where, on the slopes, either solitary or in clumps, it often forms a low tree of from 8 to 12 feet high. In this form, when furnished with branches from the ground, it is by no means an inelegant tree. In other places, its form varies much according to situation, from a low scrubby bush to a small tree with an undivided trunk.

Juniperus communis compressa.—A compact little shrub of conical form, attaining the height of only a few inches. The branches and branchlets are slender, erect, and grow close together; the leaves are short, thin, and bright green.

It is one of the smallest of Conifers; the very diminutive size of the plant rendering it interesting. It is found on the Pyrenees at 5,000 feet of elevation.†

Juniperus communis cracovia is known in gardens as the Polish Juniper, from its having been brought from the neighbourhood of Cracow. It is an erect robust variety, with abundance of foliage, and when growing in strong loamy soils the terminal branchlets are pendulous. It is intermediate between the English and Swedish forms.

Juniperus communis hibernica is the upright Irish Juniper. The branches are erect, with numerous rigid, close-set, erect branchlets, clothed with leaves shorter and deeper green than in the common kind. The habit is columnar rather than pyramidal, and it is one of the handsomest of all the varieties of *J. communis*.

Juniperus communis nana is a dwarf procumbent shrub with short branches and branchlets covered with short, sharp pointed, needle-like leaves, glaucous above and green beneath. It is found in all the Alpine districts of northern Europe and Asia, from

* Dr. Lindley, *Eng. Cyclop.*, iii., p. 311.

† Hence *hibernica compressa*, the name under which this variety is frequently found in nursery lists, is an hibernicism.

Scotland to Kamtchatka,* and in America on the shores of the Great Lakes and northwards.†

Juniperus communis oblonga is a procumbent bush, with slender branches and branchlets clothed with long attenuated leaves of a deeper and brighter green than the common kind.

It is a native of the Caucasus.

This variety rarely thrives well in England. It is very distinct as regards the colour of its foliage, and it sometimes takes an erect habit.

Juniperus communis suecicæ.—The Swedish Juniper is a fastigiate variety somewhat resembling the Irish, but more robust in growth, and having its foliage more glaucous and of a lighter green. The outline of the Swedish Juniper varies, but it is always formal, sometimes it is columnar, sometimes angular.

Juniperus drupacea.—A low or medium-sized tree with a straight erect trunk furnished with numerous short branches, which give the tree, especially in its young state, a columnar or elongated conical form. The leaves, which are in threes, are broader and stouter than in any of the Junipers, very pointed, and light green with but faint traces of the glaucescence common to this section of the genus. The fruit is remarkable both in size and colour, and may be described as consisting of fleshy closely united scales, arranged in verticils, enclosing a very hard bony kernel, generally containing three cells, but sometimes, by non-developement, only one; it is about the size of the common sloe, of a deep purple, covered with a glaucous bloom.

Habitat.—The mountains of northern Syria, Mount Taurus, places in western Asia at from 3,500 to 5,000 feet of elevation.

Introduced into European gardens in 1854, by Theodor Kotschy.‡

A very handsome and distinct Conifer, suitable for lawns, either as a single specimen or for grouping with other kinds.

Juniperus hemisphærica.—A dense little rounded bush of singular appearance, with short rigid leaves, resembling those of the common Juniper, and quite glaucous. It is a native of Mount

* *Prod.*, xvi., p. 480.

† Dr. A. Gray, *Flora of Northern States*, p. 471.

‡ *Nadelhölzer*, p. 310.

Etna, in Sicily, as high as 9,000 feet elevation,* also of other Alpine regions in the south of Europe.

Juniperus macrocarpa.—A shrub, from 10 to 12 feet high, of more open and spreading habit than the common Juniper; it has also longer leaves, and, as its name implies, bears larger berries. It is abundant throughout the Mediterranean region, and although sufficiently hardy for some parts of England, it is rarely other than an inelegant bush in British gardens.

Juniperus neaboriensis is a very distinct kind, of pyramidal or fastigiate habit, with short branches clothed with short rigid and very glaucous foliage. It is a handsome plant for the shrubbery.

The Juniper cultivated in British gardens under this name is evidently a variety of *Juniperus communis*. We have not been able to trace its origin.

Juniperus oxycedrus is the representative of the common Juniper throughout the Mediterranean region, where it is very abundant. It is a bushy, much-branched shrub, with slender pendulous branchlets, clothed with sharp spreading needle-like leaves.

Juniperus oxycedrus may be distinguished from the common Juniper by its somewhat broader and shorter leaves with more prominent white bands on the under side. In Great Britain, owing to climatal causes, it attains but small proportions, has an inelegant habit, and is quite destitute of any ornamental qualities.

Closely allied to *Juniperus oxycedrus* are *J. Cedrus*, a tall tree, native of the Canary Islands, and *J. brevifolia*, a bush 10 to 12 feet high, inhabiting the Azores, neither of which are hardy in Britain.

Juniperus rigida is a low tree or shrub, of upright habit, with a somewhat irregular, but by no means an inelegant outline, caused by projecting and drooping branches. The leaves, which form a very distinct characteristic of this species, are half an inch long, linear, rigid, erect, sharp-pointed, and distinctly marked with a glaucous furrow on the upper side—they are produced in close-set verticils of threes. The foliage and young growth, which is slender and pendulous, are of a lively light green, with a perceptible tinge of yellow, to which is superadded a glaucous hue peculiar to this species.

* Carrière, p. 16.

These tints subside to a bright cheerful green as the foliage arrives at maturity, a colour it retains through the winter months.

Habitat.—Japan, on Mount Hakone, at Atame on the east coast, and under cultivation.

Introduced into England in 1861 by Mr. J. G. Veitch.

The ornamental qualities of *Juniperus rigida* are of a high order. The graceful habit and appearance of the plant, together with the very distinct and attractive colouring of the foliage, render it one of the most useful of decorative plants, whether as a single specimen for the lawn or for grouping with other shrubs.

Section II.—Leaves generally closely appressed, scaly in form, and imbricated in the type.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNÌPERUS EXCÈLSA (*Bieberstein*)	*Juniperus orientalis fœtidissima* (Tournefort) ,, *religiosa* (Royle)	The Greek or Crimean Juniper	Greece, Asia Minor, and Afghanistan	20 to 40
,, stricta (*Hort. Rollisson*)	,, *excelsa glauca* (Hort.)	...	Garden variety	
PROCÙMBENS (*Pursh*)	,, *prostrata* (Michaux) ,, *Sabina humilis* (Hort.) ,, *repens* (Nuttall)	The Carpet Juniper	Canada and Northern United States	
RECÙRVA (*Don*)	,, *nepalensis* (Hamilton) ,, *recurva densa* (Hort.) ,, *repanda* (Hort.)	...	Himalayas ...	10— 30
SABÌNA (*Linnæus*)	,, *cupressifolia* (Aiton)	The Savin ...	South of Europe	5— 8
,, tamariscifolia (*Aiton*)	,, *Sabinioides* (Endlicher)	The Spanish Savin	Spain	1— 2
,, variegàta (*Loudon*)	... ...	The variegated Savin	Garden variety	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNÌPERUS SQUAMÀTA (*Don*)	*Juniperus dumosa* (Wallich) ,, *recurva squamata* (Parlatore)	The scaly-leaved Nepal Juniper	Himalayas ...	1— 3
THURÌFERA (*Linnæus*)	,, *hispanica* (Miller)	The Incense Juniper	Spain and Portugal	15— 25
VIRGINIÀNA (*Linnæus*)	... ...	The Red Cedar	North America	10— 50
,, aureo-variegàta (*Hort.*)	,, *virginiana aurea* (Hort.)	The Golden Red Cedar	Garden variety	
,, Bedfordiàna (*Knight*)	,, *gossainthaniana* (Loddiges) ,, *virginiana barbadensis* (Gordon)	...	,, ,,	
,, dumòsa (*Loddiges*)	,, *dumosa* (Hort.)	The Bushy Red Cedar	Garden variety	
,, glaùca (*Hort.*)	,, *argentea* (Hort.)	The Silvery Red Cedar	,, ,,	
,, pèndula (*Hort.*)	,, *Chamberlaynei* (Hort.) ,, *virginiana pendula viridis* (Hort.)	The Weeping Red Cedar	,, ,,	
,, Schotti (*Hort.*)	,, *Schotti* (Hort.) ,, *virginiana viridis* (Hort.)	...	,, ,,	
,, tripartìta (*Hort.*)	,, *tripartita* (Hort.)	...	,, ,,	

Juniperus excelsa.—A symmetrical pyramidal tree, varying in height from 20 to 40 feet, according to situation. In the Hariàb

district in Afghanistan, it is a large tree, forming fully half the forests at 9,000 feet elevation. The bark peels off in long fibrous strips, which are collected and employed by the natives for making pads for carrying their water jars on, and for other similar purposes. It has a straight trunk furnished with numerous short branches, which are also much ramified; the branchlets are clothed with thick decurrent, loosely imbricated leaves, either opposite or more rarely in threes, covered with a dusty-like glaucescence, giving the plant a greyish-green hue.

Habitat.—The Greek Archipelago, and the sub-alpine districts of Asia Minor, also Armenia and Syria (Mount Lebanon).*

Introduced in 1806 by Sir Joseph Banks.

The distribution of *Juniperus excelsa* is very extensive. Beyond the limits of the region named above, a variety of it has been met with in northern Persia; it also occurs in Arabia, Afghanistan, Beloochistan, and the Himalayas, as far east as Sikkim.† In the neighbourhood of Quettah, it grows near the summits of the limestone formation, at 10,000 to 12,000 feet elevation, and is the only valuable timber tree in the district. And on the mountains of Abyssinia, a tall Juniper has been discovered, and named *J. procera*, but which is believed to be a form of *J. excelsa.*‡ This probably marks the southern limit of the Junipers in the Eastern Hemisphere.

A Juniper has been introduced from the Himalayas, under the name of *Juniperus religiosa*, so called by Dr. Royle, from its being associated with the religious rites of the natives. M. Carrière considers it to be only a variety of *J. excelsa* (*Traité*, p. 40); but by Parlatore, it is referred to *J. chinensis* (*Prod.*, xvi., p. 488). The specimens in British gardens are scarcely distinguishable from the typical form of *J. excelsa.*

Juniperus excelsa stricta differs from the species in having a more tapering outline and more glaucous foliage. The plant is of a greyish-white colour, slightly tinged with the bluish-green common to the tribe.

The pleasing colour and symmetrical habit of this variety, render it very ornamental. It originated in the Nursery of Messrs. Rollisson, at Tooting.

Juniperus procumbens.—A creeping spreading shrub, never

* *Prod.* xvi., p. 484. † Sir J. D. Hooker, *Himalayan Journals*, i., p. 256.

‡ Arbor excelsa, *Junipero excelsæ* affinis, sed ab illa satis distincta.—*Prod.* xvi., p. 486.

rising above a few inches from the ground, closely resembling the common Savin in the colour of its foliage, with the young growth more glaucescent. It is the representative of the Savin in North America, where it is found on the sandy beaches of Newfoundland, around Lake Huron, on the borders of swamps from Maine to Wisconsin, and along the upper course of the Missouri.

Dr. Siebold affirms that it is also found in Japan, not only in cultivation, but also abundantly in a wild state on the mountains of Nippon (*Flor. Jap.*, ii., 60).

Juniperus recurva.—A shrub or bush, from 5 to 8 feet high, growing among the crags and rocks of the Himalayas, from Cashmere to Bhotan, but in the valleys, a tree 30 feet high.* It is a very distinct species with recurved, pendulous, feathery branchlets, clothed with loosely imbricated pointed leaves, generally in threes, of a greyish-green colour; intermixed with these are the rusty-brown chaffy or withered persistent leaves of the preceding year, which, with the pendulous branchlets, give the plant a drooping and sickly but picturesque appearance.

The dicœcious character of the Junipers is often shown by a marked dissimilarity in habit or appearance in the different sexes of the same species. *Juniperus recurva* is an instance of this. In this species the *mas* or male form is more dense, dwarfer, and the foliage looser than in the *fœmina* or berry bearing form, which is more open, and has the branchlets and small growth more pendulous and the leaves more closely appressed to the stem. It is the latter form that is most commonly seen in British shrubberies.

Juniperus Sabina is the common Savin of gardens and shrubberies, well known as a bushy much branched shrub of spreading irregular habit. The branchlets are entirely covered with small, scale-like, imbricated leaves, emitting a very disagreeable odour when bruised. The berries are blackish-purple, and about the size of a small currant.

Habitat.—The sub-Alpine districts of southern Europe, from the Pyrenees to the Caucasus.

Introduced into England prior to 1548, as it appears in Turner's "*Names of Herbes*," published in that year.

* Sir J. D. Hooker, *ex Prod.*, xvi., p. 482.

The Savin and its varieties are essentially mountain plants, and thrive best in light soil in sunny and airy situations. The common Savin is a useful plant for the background of the rockery and for variety in the shrubbery.

Juniperus Sabina tamariscifolia is a low trailing plant of neater habit, and with foliage of a brighter green than the type.

Juniperus Sabina variegata has many of its branchlets creamy-white or pale yellow, which gives the plant a spotted or chequered appearance. It is a useful shrub for the rockery and winter bedding.

Juniperus squamata is a decumbent creeping shrub, much branched and spreading, rarely exceeding a yard in height. The branches are furnished with numerous short stiff branchlets, clothed with rigid, sharp pointed, scaly leaves, generally in threes, very persistent, and glaucescent.

Habitat.—The Himalayas, chiefly in Nepaul and Thibet, at elevations of from 10,000 to 15,000 feet.

Introduced into England in 1824.

Juniperus thurifera.—A small tree, with an erect, tapering, slender trunk, furnished with short branches, which are spreading in the lower portion of the tree and ascending in the upper portion, giving it an elongated conical form tapering to a sharp point. The branches are much divided into small spray covered with minute, scale-like, greyish-green leaves in opposite pairs, and clasping the stem when mature, but slightly spreading in the young growth.

Habitat.—Spain on the Sierra Nevada in Andalusia; Portugal near Cape St. Vincent; Algiers near Medina.*

Introduced in 1752 by Miller.

Juniperus virginiana is the Red Cedar of gardens and shrubberies. It shows much diversity in habit and foliage, varying in size from a dwarf bushy shrub to a tree with an erect trunk 50 to 60 feet high, and in colour from a deep glossy green to a light glaucous green, with many intermediate shades, tinged with red,

* *Prod.*, xvi., p. 487.

yellow, or brown. In its most familiar aspect it is a medium-sized tree of pyramidal form, with branches that are at first erect or sub-erect, afterwards horizontal, and in old trees frequently decumbent. The branchlets are numerous, often crowded, and clothed with short acicular leaves in whorls of threes, but frequently they are minute, scale-like, and imbricated like those of the common Savin. The berries, which are no larger than small peas, are dark blue, covered with a white glaucous bloom.

Habitat.—North America, from the Great Lakes to the Mexican Gulf, and from the Atlantic to the Rocky Mountains.

Introduced in 1664, by Evelyn.

The Red Cedar is distributed over a large extent of country. "From Lake Champlain it spreads through the Atlantic States without interruption to Florida, and thence round the Gulf of Mexico to beyond St. Bernard's Bay. Further inland it is less common, but it occurs abundantly on the mountain slopes of Nevada, and it has been seen even further west; it is also met with in Texas and New Mexico. Closely allied forms also occur in the Bermuda islands. (*Juniperus bermudiana*), and Mexico (*J. mexicana*). In so extensive a range the Red Cedar varies much in form and colour of foliage; in dry and sterile rocky places in the Northern States it is a mere shrub; in the more humid and warmer climate of Virginia it is a tree 50 feet high. Under cultivation it is also polymorphous, of which every seed bed furnishes abundant instances, so that it is not easy to select any particular type as a representative one for the whole species. M. Carrière* is of opinion that this variety of form is an effect of the dicœcious character of the plant." Il y a des individus exclusivement mâles, d'autres exclusivement femelles, et d'autres enfin qui, à des degrés differents, portent les deux sexes. Ce qui est encore à remarquer, c'est ce que ces caractères agissent sur le facies, et qu'elles donnent souvent aux plantes un aspect particulier. Cette particularité, qui probablement s'applique à d'autus espèces de Juniperus pourrait peut-étre expliquer la multiplicité qu'en a faite d'espéces qui, pour beaucoup, ne sont probablement que des formes d'un seul type.

The economic value of the wood of the Red Cedar is very great, and the uses to which it is applied in America are numerous. The matured or heart wood is of a fine red colour, whence the popular name of the tree; it is of close texture and fine in grain, admitting of a high polish; it is also very fragrant, on which account it is employed in cabinet work and inlaying; it is durable, and free from the attacks of insects; it resists for a long time the action of water,

* *Traité de Général Conifères*, p. 47.

and was much used by the earlier colonists and settlers for water shoots, stakes, and under ground work.* But the tree does not in general attain a sufficient size to yield planks of more than a few inches in breadth and thickness, which has proved an impediment to its more extensive use for constructive purposes. The chief use made of the wood in England is in the manufacture of "Cedar pencils," but even for this purpose the wood of the Bermuda Juniper has hitherto been preferred, but which is now becoming too scarce to supply the demand. The average growth of the Red Cedar in England is not more than from 12 to 15 feet in ten years, and the tree does not often attain a timber-like size, except in deep and rich soils that could be far more profitably cropped by other vegetation, so that it cannot be recommended for planting in this country for the sake of its timber. As an ornamental tree for the shrubbery its qualities are well known, and these are even more manifest in some of the varieties into which it has sported under cultivation.

Among the most distinct are the following :—

Juniperus virginiana aurea-variegata.—In this variety many of the terminal and lateral branchlets are deep yellow; the variegation is, however, very unequally distributed, being in some places the entire branchlets, in others a mere spot.

Juniperus virginiana Bedfordiana is a very handsome variety, with longer and more slender branches, and with foliage of a brighter green than in the common form. The ultimate branchlets are filiform and pendulous.

The origin of this beautiful variety is not certainly known. Mr. Gordon (*Pinetum*, p. 156), states that it is a native of Barbadoes and other West Indian Islands, but quotes no authority in support of the statement. It was extensively distributed by Messrs. Loddiges, under the name of *Juniperus gossainthaniana*, thereby indicating a Himalayan origin, which is accepted by M. Carrière (*Traité*, p. 45), but rejected by Professor Parlatore, who considered it to be a garden variety only.

Juniperus virginiana dumosa.—A dwarf variety, with a rounded top, and foliage of bright green during the growing season. The leaves are for the most part acicular, either opposite or in threes, others are scale-like and closely imbricated.

Juniperus virginiana glauca.—The Silver Juniper of gardens.

* Loudon, *Arb. et Frut.*, p. 2497, ex. Michaux.

A free-growing variety, with branches more slender than in the usual type. The branchlets and their foliage during the growing season are of almost silvery whiteness, which changes in winter to a pale green.

Juniperus virginiana pendula.—"There are three forms of the pendulous Red Cedar to be found in collections: one of the *male* form, another the *female,* and the third a *bright green* one. The male kind has shorter and much more numerous branchlets, while the female one has longer, more slender, and much fewer branchlets; the third variety is of a light glossy green." *

Of these forms the *femina* is the best; the foliage is richer in colour than in the other two forms, and although the branches springing from the trunk are horizontal, the branchlets have the pendulous character strongly developed.

Juniperus virginiana Schotti.—A variety of pyramidal habit, distinguished by its peculiarly bright green foliage.

Juniperus virginiana tripartita is a dwarf spreading variety, resembling in habit the common Savin, but much denser; the leaves are acicular, short, sharp pointed, spreading, and glaucous.

Juniperus bermudiana.—A densely branched pyramidal tree, attaining a height of from 40 to 50 feet. The foliage is dimorphous; on the young plants the leaves are acicular, and arranged in threes, but as the tree advances in age they become scale-like and imbricated. It was in cultivation in England prior to 1700, but is seldom seen in collections except in a young state—being too tender to endure severe winters.

From *Juniperus bermudiana* was obtained the fragrant wood used in the manufacture of "Cedar" pencils, till the increased demand made the tree scarce. There was (1872) still existing in Bermuda an old Cedar tree, the diameter of whose trunk was 58 inches.†

Juniperus davurica.—A low spreading shrub, native of Siberia. Introduced in 1791,‡ but now rarely seen in this country. The Juniper met with in collection under this name is *Juniperus canadensis*, or a variety of *J. communis.* §

Juniperus pseudo-Sabina.—A low shrub, resembling the common

* Gordon, *Pinetum*, p. 156.
† *Gardeners' Chronicle*, 1872, p. 1035.
‡ Loudon, *Arb. et Frut.*, p. 2500.
§ Gordon, *Pinetum*, p. 141.

Savin in habit and aspect, found on the Altain mountains, whence it was introduced into Europe through the Imperial Botanic Garden at St. Petersburgh.* It is quite rare in England.

Section III.—Leaves both acicular and scale-like on the same plant at different stages of growth.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNIPERUS CHINÈNSIS MÀS (*Linnæus*)	*Juniperus dimorpha* (Roxburgh) ,, *taxifolia* (Hooker)	The Chinese Juniper, male form	China and Thibet	20— 25
,, fœmina (*Linnæus*)	,, *cernua* (Roxburgh) ,, *flagelliformis* (Reeves)	The Chinese Juniper, female form	,, ,,	20— 25
,, albo-variegàta (*Fortune*)	... ...	The variegated Chinese Juniper	Garden variety, China	
,, aùrea (*Hort. Young*)	... ...	Young's golden Chinese Juniper	Garden variety...	
JAPÒNICA (*Carrière*)	*Juniperus procumbens* (Siebold)	The Japanese Juniper	Japan	3— 5
,, aùrea (*Fortune*)	... ...	The golden Japanese Juniper	Garden variety, Japan	3— 5
,, aureo-variegàta (*Hort.*)	... ...	The variegated Japanese Juniper	Garden variety...	3— 5
OCCIDENTÀLIS (*Sir W. Hooker*)	*Juniperus excelsa* (Pursh) ,, *dealbata* (Loudon) ,, *californica* (Carrière) ,, *pyriformis* (Lindley) ,, *venusta* (Hort.) ,, *fragrans* (Hort.)	The western Juniper	California, Oregon, &c.	10— 50

* According to Parlatore, "Species a *Junipero Sabinâ* valde distincta nec cum aliqua confundenda."—*Prod.*, xvi., p. 482.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
JUNIPERUS PACHYPHLŒA (*Torrey*)	... ...	...	New Mexico	
PHŒNICEA (*Linnæus*)	*Juniperus bacciformis* (Carrière) ,, *Langoldiana* (Hort.) *Cupressus bacciformis* (Weldenow)	The Phœnician Juniper	Greece, Asia Minor, &c.	15— 18
SPHÆRICA (*Lindley*)	*Juniperus Fortunei* (Hort. Van Houtte) ,, *chinensis Smithii* (Loudon)	The globular-fruited Juniper	North China ...	25— 30
,, Sheppardi (*Hort.*)	,, *sphærica glauca* (Fortune)	Sheppard's Juniper	North China	

Juniperus chinensis.—A low or medium-sized tree, of erect or elongated pyramidal habit, with short branches and dimorphous foliage. It is dicœcious, each sex presenting an aspect distinct from the other. The *mas* or male form has numerous branches, the higher ones ascending or nearly erect, and all very much ramified; the leaves are generally in threes, acicular, stiff, and spreading, glaucous or bright green; the small staminate orange-yellow flowers are produced in profusion all over the plant in spring. The *fœmina* or female form has its branches longer, more distant, and more spreading than those of the male; the leaves are in opposite pairs, short, scale-like, and closely imbricated; the berries are small, of a brownish-violet colour, and rarely contain more than three seeds. The dimorphous foliage is common to both forms; acicular leaves are frequently found on the small side shoots and lower branches of the fœmina; and the imbricated scale-like leaves are most common on the outer and upper branches of the mas.

Habitat. — China, Thibet, and the Himalayas of Cashmere and Nepaul.*

* *Prod.*, xvi., p. 488, ex Webb et Griffith.

Introduced in 1804.*

The Chinese Juniper is one of the most useful of small evergreen trees for the shrubbery and for ornamental planting generally; for single specimen for small lawns the *mas* form should be preferred. It is quite hardy, and thrives in every description of soil not too wet.

Juniperus chinensis aurea.—A beautiful and distinct variety, having the whole of its young growth suffused with deep golden-yellow. The colour is heightened by full exposure to the sun.

It originated from a male plant in the Nurseries of Mr. Maurice Young, at Milford, near Godalming.

Juniperus chinensis albo-variegata has its foliage more glaucous than the species, with numerous twigs, and many of its terminal shoots pure white. The plant is of dwarf compact habit.

It was introduced to British gardens by Mr. Robert Fortune from Japan.

Juniperus japonica is probably an alpine form of *J. chinensis*. It is a dwarf bush, sometimes with only a single stem, but oftener with a divided one; in the latter case the branches or divisions of the stem assume a procumbent habit. The leaves are at first acicular, very close set, arranged in threes, bright green beneath, and distinctly marked with two silvery glaucous lines above; on the adult plants they are scale-like and bright green.

Juniperus japonica aurea has the growth of the current season tinged with golden-yellow, which gradually changes to light green. The primary branches in this variety are few, and produced at irregular intervals; they are robust and long in proportion to the height of the trunk or principal stem, decumbent and straggling, and densely clothed with spray and foliage.

Juniperus japonica aureo-variegata is quite distinct from the preceding, both in habit and colour. It is a dense dwarf shrub, having many of the branchlets and terminal growths of a deep golden-yellow.

* Carrière, *Traité Général des Conifères*, p. 31.

Juniperus occidentalis.—A tall tree or low shrub, according to the situation in which it is growing. In the rich alluvial valley of the Columbia River, where it was discovered by Lewis and Pursh, and called by them *J. excelsa*, it is a fine erect tree, 50 feet high. On the mountain of San Bernardino, in California, where it was found by William Lobb, and from whose specimens Dr. Lindley described it under the name of *J. pyriformis*, it is a shrubby bush, 10 to 12 feet high.* In the young state the leaves are in whorls of threes, spreading, sharp pointed, and glaucous; in the adult plant they are short, blunt, imbricated, and closely appressed to the stem. The berries are small, deep purple, and covered with a glaucous bloom.

Habitat. — North-west America, from the Fraser River to the Sacramento, and from the Rocky Mountains to the Pacific, but only in different localities within this region. Also east of the Rocky Mountains from Utah to Texas.

Introduced in 1839.†

A variety called *utahensis* is abundant in the State of Nevada. It is described by Professor Sargent, of Cambridge, Massachusetts, as a low bushy tree, branching from the ground, with a stout trunk which rarely exceeds 2 feet in diameter; it is of exceedingly slow growth owing to the dryness of the climate. Another variety called *monosperma* occurs at Pike's Peak, Colorado, and extends through western Texas and New Mexico to Arizona. A third variety named *conjungens* is an important timber tree of western Texas, where it forms forests of considerable extent.

Juniperus pachyphlœa.—A slender upright tree, of tapering habit, with short erect branches; the leaves are subulate, almost squamiform, closely imbricated, thick and broad at the base, and sharply pointed. The young growth is very glaucous, which gives the plant quite a whitish appearance.

Habitat.—The mountains of western New Mexico and Arizona.

Juniperus pachyphlœa is still rare in British gardens, and the above description is only applicable to the few specimens of it which we have seen. It is quite possible that as it becomes more common the

* *Gardeners' Chronicle*, 1855, p. 420.

† Loudon's *Encyclopœdia of Trees*, p. 1090, but this date is probably incorrect. It was either introduced earlier by Douglas, or later by Hartweg, as there is no record of any trees and shrubs being introduced from California between 1832 and 1846.

habit will be found to vary. *J. pachyphlœa* is certainly a remarkable, but can scarcely be called a handsome species. Parlatore observes of it, "*J. occidentali* valde affinis et forsan ejus varietas."

Juniperus phœnicea.—A low tree or shrub-like bush, of conical or pyramidal habit. Its stem is furnished with numerous slender branches much divided at their extremities, and clothed with small scale-like bright green leaves, the glaucescence common to the tribe, being absent or nearly so in this species. The dicœcious character of the Junipers is frequently departed from in *J. phœnicea*, so that staminate and pistillate flowers are found on the same plant, but always on different branches of it, and thus showing the peculiarity of some branches being covered with berries while the others are unfruitful. The berries are about the size of peas, and of a pale yellow in this country, where they generally fail to arrive at maturity, but in the south of Europe they are blackish-violet when ripe.

Habitat.—The Mediterranean region.

Introduced in 1683 by Mr. James Sutherland, of the Botanic Garden, Edinburgh.

Juniperus sphærica combines the upright mode of growth of *J. chinensis* with the habit of *J. phœnicea* in its much divided tufted branches and scale-like imbricated leaves, the colour of the foliage being on the whole brighter than the latter and less glaucescent than the former. It shows the same peculiarity as *J. phœnicea* in often departing from the dicœcious character of the Junipers, so that particular branches are sometimes found loaded with berries while the remainder of the plant has none. The berries are of globular or spherical form, which suggested to Dr. Lindley the specific name.*

Habitat.—North China.

Introduced in 1846 by Mr. Robert Fortune.

Juniperus sphærica Sheppardi.—A shrubby bush, of rather spreading habit, rendered dense by its numerous branchlets. The leaves are acicular, rigid, open, and sharp pointed. In autumn the foliage and young growth becomes very glaucous, almost of silvery whiteness. It is a recent introduction from China.

* Parlatore remarks that "*Juniperus sphærica* differt a *J. chinense* floribus monoicis, ramis crassioribus, brevioribus, subtetragonis; foliis subpatulis et glandula ovali vel subrotunda prope basin præditis, et præcipue galbulis majoribus."—*Prod.*, xvi., p. 488.

Tribe IV.—TAXINEÆ. The Yew Tribe. *(Taxads).*

Amidst much variety in habit and aspect, the Taxads, sufficiently hardy for the climate of Great Britain, possess the following common characters, those of fructification being deemed essential, and distinguishing the members of the tribe from other Coniferæ.

Their growth, with but few exceptions, is comparatively slow, and their wood hard, tough, and very durable. Their leaves are narrow, flattened, and entire, frequently distichous or subdistichous in arrangement, occasionally scattered, but in Ginkgo (Salisburia) they are expanded into a fan-like shape, striated with veins of uniform thickness, and notched at the edges.

The flowers are monœcious or dicœcious and solitary; the male flowers having the stamens united at the base, and the female with the ovule unprotected by scales. The fruit is always one seeded (monospermous) and not collected into cones as in the other Tribes; the seed is usually enclosed in a fleshy covering.

The Taxads are resinous, like other Coniferæ, but their secretions are not abundant, nor are they applied to any useful purpose. The young growth and foliage of the common Yew is known to be poisonous, and it is highly probable that those of other members of the tribe are more or less noxious. The timber of many of the Taxads is extremely valuable in their native countries, as that of the Yew in Great Britain, the Totara Pine (*Podocarpus Totara)* in New Zealand, *Dacrydium Franklinii* in Tasmania, *Podocarpus cupressinus* in Java, &c.

The Taxads are but thinly spread over the globe. The Yew has an extensive area of distribution in the temperate regions of the northern hemisphere; the Podocarps take the place of the Yew between the tropics, and the tribe is represented in the southern hemisphere by *Dacrydium, Phyllocladus, Saxe-Gothœa,* &c.

I.—TAXUS *(Tournefort).* The Yew.

The essential characters of Taxus are sufficiently indicated above. As regards its distribution, the Yew is rarely met with beyond the

limits of the temperate zone of the northern hemisphere, over which it is sparingly spread. Preferring elevated situations often to an altitude of from 4,000 to 5,000 feet, it nowhere forms a continuous forest like many members of the Fir and Pine Tribe, and even when plentiful it is mixed with other trees. On English Downs it is sometimes found solitary, forming a conspicuous object from afar; and generally in its wild state in this country, it is observed to be more frequent on the north slopes of rising ground than on any other aspect, and not unfrequently in the shade of deciduous trees. Occasionally it is met with in groups, or forming small groves unmixed with other trees.

One of the most remarkable of the Yew groves occurs on Mickleham Downs, near Leatherhead, in Surrey, on the estate of A. Dickson, Esq., of Cherkley Court. Here an extensive area is covered with Yews, almost unmixed with other trees and shrubs, except a few Junipers scattered here and there through the grove. The aspect of some of these Yews is peculiar and even beautiful. Groups of from five to a dozen may be seen with their trunks in close proximity to each other, forming a dense copse or clump, and each tree being thickly furnished with branches from the ground on the side freely exposed to the air, the group has the appearance of being one tree of gigantic dimensions. In one part of the grove, a considerable space is completely covered with Yews, all of which, except the outside trees, have lost their lower branches, those remaining on the trees being confined to the tops only, and with their foliage forming a dense canopy impervious to the sun's rays, the interior being lighted only at distant intervals by small openings in the thick foliage. On entering the thicket the aspect is weird and sombre, and when in winter the tops of the trees are covered with a thick coating of snow, and the diminished light takes a hazy yellowish hue, the appearance of the interior causes an indescribable feeling of depression and gloom.

"There is a famous clump of Yews at Kingsley Vale, on the South Downs, near Chichester, and another on the North Downs, in a slight hollow of the hill, near Guildford. Numerous great Yews here stand in a natural park or wood opening, among Hawthorns and several indigenous shrubs, Holly, Furze, Blackthorn and Crab, with Butcher's Broom beneath. This retired covert, forming part of the primeval forest, is blameless at present of a foreign tree."*

On the continent of Europe the Yew is more or less common in all the mountain and hilly districts, from the Mediterranean to

* H. Eversheld, in *Gardeners' Chronicle*, 1876, vol. vi., p. 99.

Sweden and Norway, as far as latitude 60° N., but it is very rare in Russia, a circumstance accounted for by the level nature of the country. It is also found in Algeria, on Mount Taurus in Cilicia, in Armenia, and as far eastwards as the River Amour.* On the Himalayas, "it occurs as high as 10,000 feet, and spreads east from Kashmir to Assam and the Khasia hills; and the Japan, Philippine Islands, Mexican and other North American Yews belong to the same widely diffused species. In the Khasia, its most southern limit, it is found as low as 5,000 feet." † It is frequent in Canada and the north-east States, and locally met with in Florida, California, and Oregon. ‡

The Yew is of geological antiquity; it formed part of the forests of Britain at a period long anterior to historic times. It is found among the buried trees on the Norfolk coast, near Cromer. § It also "crops up in another forest, now beneath the Bristol Channel, in which, if there be any truth in bones, the elephant, rhinoceros, and beaver roamed." ||

Taxus, the Latin name of the Yew, from the Greek τάξος (taxos), which, from τάσσω (tasso) "to arrange," probably in reference to the two rowed or distichous arrangement of the leaves, or probably from τόξον (toxon) "a bow," the wood being used in ancient times for making bows.

Yew, or Yeugh. In Chaucer and other old authors, ewe; in Aubrey's *Wilts*, eugh; Anglo Saxon, iw; German, eibe; Spanish, iva and tejo; French, if; Welsh, yw; Media Latin, ivus, iva, or ua, "an abbreviation of ajuga, which was a misspelling of abiga, a plant mentioned by Pliny as being the same as χαμαὶπιτυς (chamaipitus) so called from its causing abortion. These names of the Yew we find so inseparably mixed up with others that mean Ivy, that dissimilar as are the two plants there can be no doubt that their names are, in their origin, identical. How they came to be attached to these trees, the Yew and the Ivy, is the difficulty." (Prior, *Popular Names of British Plants*).

In the following synoptic table the varieties placed under *Taxus baccata* originated in Great Britain, or in continental nurseries.

* De Candolle's *Prod.*, xvi., p. 500.

† Sir J. D. Hooker's *Himalayan Journals*, vol. ii., p. 25.

‡ Dr. Asa Gray considers the Canadian Yew to belong to the same species as the Old World Yews; the very local one in Florida is slightly different; that of California and Oregon differs a very little more. *Address to American Association of Science*, 1872.

§ Dr. Ramsay, *Physical Geology of Great Britain*, p. 134.

|| H. Evershed in *Gardeners' Chronicle*, 1876, vol. vi., p. 99.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
TÀXUS ADPRÈSSA (*Knight*)	*Taxus tardiva* (Lawson) *Cephalotaxus tardiva* (Siebold) (?) *Taxus baccata microphylla* (Jacques) ,, *parvifolia* (Wendworth) ,, *brevifolia* (Hort.)	The flat-headed Yew	...	8 to 10
,, erècta (*Hort. Standish*)	... ...	...	Garden variety	
,, variegàta (*Hort.*)	... ...	...	,, ,,	
BACCÀTA (*Linnæus*)	... ...	The Common Yew	Europe and Asia	30— 45
,, aùrea (*Hort.*)	... ...	The golden Yew	Garden variety	
,, Dovastònii (*Loudon*)	*Taxus Dovastonii* (Hort.) ,, *pendula* (Hort.)	Dovaston's or the Westfelton Yew	,, ,,	30— 35
,, elegantìssima (*Hort.*)	... ...	...	,, ,,	
,, erècta (*Loudon*)	*Taxus baccata pyramidalis* (Hort.)	The upright Yew	,, ,,	20— 25
,, erìcoides (*Hort.*)	,, *empetrifolia* (Hort.) ,, *microphylla* (Hort.)	The Heath-like Yew	,, ,,	4 — 5
,, fastigiàta (*Loudon*)	,, *hibernica* (Hort.)	The Irish Yew	...	20— 25
,, ,, aùrea (*Hort. Standish*)	... ...	...	...	
,, ,, aureomarginàta (*Hort. Fisher*)	... ...	The golden Irish Yew	Garden variety	
,, fastigiàta argenteovariegata (*Carrière*)	*Taxus fastigiata argentea* (Knight)	The silver Irish Yew	,, ,,	

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
TÀXUS BACCÀTA	... ...	The yellow-berried Yew	...	25— 30
,, fructu-lùteo (*Loudon*)				
,, nàna (*Hort.*)	*Taxus Foxii* (Knight)	The dwarf Yew	...	3 — 5
,, nìgra (*Hort. Paul*)	,, *baccata glauca* (Carrière)	The glaucous Yew, or Blue John		
BREVIFÒLIA (*Nuttall*)	,, *Lindleyana* (Murray) ,, *occidentalis americana* (Douglas) ,, *Boursierii* (Carrière)	The Californian Yew	California and Oregon	30— 50
CANADÈNSIS (*Wildenow*)	,, *baccata canadensis* (Loudon) ,, *baccata minor* (Michaux) ,, *procumbens* (Loddiges)	The Canadian Yew	Canada and north-eastern States	5 — 15
,, variegàta (*Hort.*)	... ...	The variegated Canadian Yew	Garden variety...	
,, Washing-tònii (*Hort.*)	*Taxus canadensis aurea* (Hort.)	Washington's Canadian Yew	,, ,,	
CUSPIDÀTA (*Siebold*)	... ...	The Japanese Yew	Japan	15— 20

Taxus adpressa.—A low tree or shrub, with numerous spreading branches clothed with ovate-oblong blackish-green leaves, slightly inclined upwards and forwards, and distichously arranged in double rows. It is called the flat-headed Yew on account of its spreading habit and want of a leader. It is a very distinct Yew.

The origin of *Taxus adpressa* is uncertain. It is generally believed to have been introduced from Japan, but our collector failed to meet with it in that country, either in a wild state or in cultivation. A higher degree of probability is attached to the supposition of its having originated in a once famous nursery in north-east London.

Taxus adpressa erecta is an upright variety of the preceding, which originated in the Nursery of Messrs. Standish, at Ascot.

Taxus adpressa variegata has the tips of many of its branches creamy-white.

Taxus baccata.—The common Yew in its most usual form, in a wild state, is a low tree rarely exceeding 40 feet in height, often much less, varying in height and size according to the soil and situation in which it is growing, and presenting a sky outline rather peaked and pointed, but becoming rounded in mature age. It has a short trunk, very thick in proportion to the size of the tree, which divides or sends out branches at a short distance from the ground. The branches are much subdivided, and the branchlets are clothed with dark green shining persistent leaves in two lateral double rows, but sometimes more or less scattered, especially in some of its varieties. The fruit consists of a brownish oval nut, enclosed in a glutinous scarlet envelope or pericarp, open at the top, through which the nut protrudes. The fruit-bearing trees are very handsome in autumn when covered with their bright coloured berries.

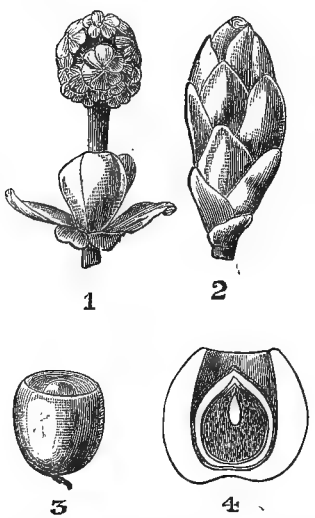


Fig. 61.—Fructification of the Common Yew. (1) Male or staminiferous flower; (2) Female or ovule-bearing flower; (3) Ripe fruit; (4) Longitudinal section of the seed showing the position of the embryo.

The Yew, like the Juniper, is dicœcious relatively—not absolutely—intermediate degrees of fertility being constantly met with. Thus some trees are annually covered with fruit, others bear but little—certain branches only being fertile, while others, again, never produce any. Many individual trees are completely dicœcious, but there are others that are not so. Loudon observes that "The Yew is of slow growth, but in favourable situations it will attain the height of 6 or 8 feet in ten years. In twenty years it will attain the height of 15 feet, and it will continue growing for one hundred years, after which it becomes comparatively stationary, but will live for many centuries." * In a light warm soil the growth of young plants is somewhat more rapid than that stated by Loudon.

* *Arb. et Frut.*, p. 2069.

The wood of the Yew is exceedingly hard and close-grained, of a beautiful reddish-brown, susceptible of a high polish, and very durable, tough, and elastic—qualities that were turned to account during many centuries in the making of bows used in warfare and the chase, and in modern times for archery. Yew wood was also formerly much used in the manufacture of articles of domestic furniture, many antique and curious specimens of which are still preserved in museums, &c. The spray and foliage of the Yew are poisonous to cattle. The berries are glutinous, and have a sweet taste; they are often eaten by children without being followed by harmful consequences. The kernel, too, is edible, and has a bitter flavour not unlike that of the seeds of the Stone Pine (*Pinus pinea*).

The association of the Yew with religion and places of worship is of very ancient date. Many hypotheses have been brought forward explanatory of the cause of the selection of this tree for planting in proximity to churches and abbeys, or, perhaps, it would be more correct to say, the building of churches and abbeys in proximity to large and full grown Yews; for it is indisputable that the finest and most venerable trees at present existing in Britain are to be found in churchyards, and in the vicinity of old priories and abbeys, but it is by no means certain whether in all cases, or even in the majority of them, the Yews were planted subsequent to the building of the edifice, or the edifice erected near the spot where the Yews were already standing.* The true cause of the association, in this country at least, is not, we think, difficult to be found—this is in the character and habit of the tree itself. There is no other native evergreen tree at all to be compared with the Yew as regards its foliage, its massive sombre aspect, and its longevity, and hence the Yew would be naturally selected to represent the feelings, the sentiments, and the hopes associated with burial-grounds and in connection with places of worship where sentiments and feelings are most likely to seek expression by visible representatives or enduring monuments. The feeling of Hope lives in its evergreen foliage; Sorrow is remembered in its dark and sombre shade, and Veneration is awakened in its aged aspect. It may be safely assumed from the known antiquity of many Yews still standing in churchyards and the like places, that the association of the Yew with religion must be of very ancient origin; and the probability is very great that it took its rise at an epoch anterior to the introduction of Christianity into Britain.

Among the ancient Yews still existing, that are, or have been associated with sacred edifices, the following are celebrated:—

* There was a very ancient Yew in the churchyard of Kirkheating, near Huddersfield. The inhabitants of the village have a tradition that the church (which dates before 1245) was built to the tree, and not the tree planted to the church. It was living in 1864, but is now dead.—G. Roberts, in *Science Gossip*, 1875, p. 70.

The Fountains Abbey Yews, in Yorkshire, are very aged. The Abbey was founded in 1132. The monks are said to have taken shelter under the Yews growing on the declivity of the hill while the building was in progress.

In the churchyard of Overton, in Flintshire, is a very ancient Yew, now fast going to decay. The trunk, quite hollow, is upwards of 30 feet in circumference at 3 feet from the ground.

Among the fine old Yews in Gresford churchyard, in Derbyshire, is one supposed to be over a thousand years old. The circumference of the trunk at 5 feet from the ground is 29 feet, and the height of the tree upwards of 60 feet.

In the churchyard of Darley, in Derbyshire, is a venerable tree, 30 feet in circumference. The trunk, which is hollow, is only regular and straight to about 10 feet from the ground when it divides into several large limbs, two of which are erect and the others spreading. It is a female or berry-bearing tree, and believed to be upwards of one thousand two hundred and fifty years old.

In the churchyard of Tisbury, in Dorsetshire, is an enormous Yew tree whose trunk is 37 feet in circumference. It is quite hollow, and the interior is entered by means of a rustic gate.

The Crowhurst Yew, on the borders of Kent and Surrey, not far from Edenbridge, is one of the largest, and probably one of the oldest, in England. It is still flourishing. The inside is hollow, and has been fitted up with a table in the centre and benches around it for as many as sixteen persons.*

Other very ancient Yews are to be seen at Hurstmonceaux, in Sussex; at Withycombe, in Devonshire; at Marden, in Herefordshire; at Manhilad, near Monmouth; on the North Downs, near Guildford, in Surrey, &c.†

The association of the Yew with early English History is varied and important. Venerable trees still mark the spots where great events have taken place, and others are associated with the names of historic personages. The Ankerwyke Yew, near Staines, witnessed the conference between King John and the English Barons in 1215, and in sight of which Magna Charta was signed. It is 27⅔ feet in circumference, and most probably its age exceeds one thousand years old. Under the Loudon Yew, in Ayrshire, it is said that Bruce bestowed the ancient castle and estate on the Loudon family, and on the same spot, some centuries afterwards, John, Earl of Loudon, signed the Act of Union between England and Scotland. This tree is over 40 feet high, with a trunk 4½ feet in diameter at 12 feet from the ground.

* *Science Gossip*, 1874.

† The above are a few instances selected from many. The reader desirous of further information should refer to Loudon's *Arb. et Frut.*, pp. 2073—2082; to the pages of *Science Gossip*, for 1873-4-5; the *Gardeners' Chronicle*, &c.

In a much wider bearing the Yew played a prominent part in our early history, as supplying the material of which the bows of the archers were made, and on that account was the subject of many statutes of our early kings, and afterwards of Parliament, which made provisions for the preservation and planting of Yews, and for the supply of Yew wood for bows, for prohibiting the exportation of Yew timber, regulating the import of it, &c. Every student of English History can point to great events in which the Yew bow played a foremost part. It was essentially the Saxon weapon both for warfare and the chase; and during the earlier part of the Norman supremacy was often used with deadly effect by the oppressed natives to rid themselves of their tyrannical masters. Deeds of daring were performed, attesting the extraordinary prowess and skill of the Saxon archers; deeds that were long kept in remembrance by tradition, celebrated in song and verse, or preserved in legends which afterwards supplied subjects for modern romance.* The Yew bow was fatal to several English Kings, to Harold at Hastings, to William Rufus in the New Forest, and to Richard Cœur de Lion at Chaloux, in France. It was the skill of the English archers that enabled Henry II. to gain a footing in Ireland, and the name of Strongbow, borne by the leader of the expedition, attests the high repute in which the weapon was held. Cressy, Poictiers, and Agincourt were won chiefly by the Yew bow; it was the most popular weapon through the long civil strife between the rival houses of York and Lancaster; and both in warfare as well as in the chase, it was held in estimation long after the invention of gunpowder had prepared the way to a complete change in the system and science of war.

The association of the Yew with gardening in England began early in the sixteenth century. It was brought into prominent notice towards the end of the century by Evelyn, who claims the "merit" of being the first to introduce the fashion of clipping it into artificial shapes, which became general during the next century. It was first used in the formation of hedges for purposes of utility, but the dense growth it assumes when pruned, its apparently unlimited duration, and the readiness with which it may be cut into many shapes without imparing its vitality, soon led to its being extensively used in topiary work, which had been previously confined chiefly to the box and juniper. The dark dense foliage of the Yew, and its more robust and taller growth than the box or juniper, offered facilities for the introduction into gardens, by artificial means, of many varieties of form, and the fashion of clipping Yews into geometric figures, and also into the figures of birds, beasts, and even the human shape, became for a time a very prevalent practice, which reached its height towards the close of the

* Sir Walter Scott's *Ivanhoe, Tales of Robin Hood*, &c. See, also, the learned and eloquent Thiery in his *Conquête de l'Angleterre par les Normands*.

seventeenth and during the early part of the eighteenth century. The popularity of the Yew as an ornamental garden plant during this period may be partly accounted for by the paucity of evergreen trees and shrubs at that time available,* and the desire for variety created by the taste for gardening which began to be general among all classes. The practice gradually fell into disuse as the introduction of exotic hardy trees and shrubs became more frequent, and supplied a more natural and pleasing variety than the uncouth figures which one kind of tree was made to take, but into which Nature never intended it to grow. Many evidences of the old topiary work are still to be met with, and not a few old Yews are made to retain the figures into which they were originally cut and trimmed. Some of the most remarkable of these are to be seen at Leven's Hall, Westmoreland, where the topiary foible of our horticultural predecessors is still maintained in all its quaint antagonism to Nature.†

Not less striking but more modern, and, if we may use the expression, more rational, is the topiary work at Elvaston Castle, near Derby, the seat of the Earl of Harrington. A large portion of this consists of ornamental hedges of the common Yew, either dividing parts of the grounds from each other, or enclosing spaces devoted to special subjects; and of single specimens, both of the common Yew and its golden variety, cut into conical pyramids of uniform size and height, and of such there are upwards of one thousand. There are comparatively few representations of birds and animals; the bolder work represents the walls and bastions of a Norman castle, archways, alcoves, arbours, &c. The great extent of the topiary work at Elvaston is calculated to excite surprise rather than admiration, at the same time its extreme formality is greatly relieved by the noble Conifers of the Fir and Pine tribe which have been planted beside and around it with no sparing hand, and by the beautiful view afforded by the river Derwent, in its winding course through the grounds.

Throughout the counties of Kent and Sussex, and also in many other parts of England, chiefly in the gardens of old farm houses and wayside inns, may yet be seen an ancient Yew clipped into the figure

* The number of native evergreen trees and shrubs may be counted on the fingers, thus—Yew, Scotch Pine, Juniper, Holly, Privet, Ivy, Butcher's Broom, Spurge Laurel, and Mistleto (the Box is a doubtful native), and up to the close of the seventeenth century the number of exotic evergreen trees introduced was not much greater, and some of them were very rare. The best known were the Spruce Fir, Silver Fir, Stone Pine, Pinaster, Red Cedar, Savin, Arbor Vitæ, Evergreen Oak, Sweet Bay, Laurustine, Portugal Laurel, Phillyrea, and Arbutus.

† See the *Gardeners' Chronicle* for 1874, p. 264, where an account of the topiary work at Leven's Hall is given, illustrated with woodcuts of some of the most remarkable groups which include figures of the British Lion; Queen Elizabeth and ladies; the Judge's Wig, a number of Yews planted in a half circle, so as to form an arbour by bringing the branches over the top in a hood or wig-like fashion; and many others. These figures were first formed early in the eighteenth century, so that for upwards of one hundred and eighty years these Yews must have had their young growth cut off to keep the figures within the prescribed shape and size, a proof of the astonishing tenacity of life possessed by the Yew.

Topiary work at Elvaston Castle, near Derby.

Topiary work at Elvaston Castle. The Yew Garden.

of a bird or a quadruped; the peacock * appearing to have been popular with the yeomanry, and the fox and greyhound with the innkeepers.

The Yew sports into many varieties and sub-varieties, from which those given in the synoptic table have been selected as being useful and distinct ornamental kinds, and including some valuable additions to the resources of the gardener and landscape planter.

The specific name *baccata*, "furnished with berries," is expressive of the prolific character of the fruit-bearing Yews.

Taxus baccata aurea has the margins and tips of the leaves, and also the stems of the terminal branchlets, a rich golden-yellow during the growing season. It is one of the most useful and attractive of variegated shrubs.

Taxus baccata Dovastonii.—A remarkable variety, with longer leaves of deeper green than the common form, and with pendulous branchlets. It is a suitable plant for cemeteries, and when grown as a standard, formed by grafting it on one of the upright varieties, it supplies a quaint subject for contrast in the garden.

The origin of the Dovaston Yew is thus given by Loudon †—"The Westfelton Yew stands in the grounds of J. F. M. Dovaston, Esq., of Westfelton, near Shrewsbury, and the following account has been sent to us by that gentleman: 'About sixty years ago (now over a hundred) my father, John Dovaston, a man without education, but of unwearied industry and ingenuity, had, with his own hands, sunk a well and constructed and placed a pump in it, and the soil being light and sandy, it constantly fell in. He secured it with wooden boards, but perceiving their speedy decay, he planted near the well a Yew tree, which he bought of a cobbler for sixpence, rightly judging that the fibrous and matting tendency of the Yew roots would hold up the soil. They did so, and independently of its utility, the Yew grew into a tree of extraordinary and striking beauty, spreading horizontally all round, with a single aspiring leader to a great height, each branch in every direction dangling in tressy verdure downwards, the lowest ones to the very ground, pendulous and playful as the most graceful birch or willow, and visibly obedient to the feeblest breath of air. Though a male tree, it has one branch self-productive, and profuse of berries, from which I have raised several plants in the hope that they may inherit some of the beauty of their parent.'" This beautiful tree is

* The climbing street, the mill, the leafy lane,
The *peacock Yew tree*, and the lonely Hall.
Tennyson's *Enoch Arden*.

† *Arb. et Frut.*, p. 2082.

still flourishing, and in 1876 the circumference of its branches was found to be 72 feet, girth of trunk 7½ feet, and height 34 feet.* Seedling plants raised from the tree partook of the same pendent character.

Taxus baccata elegantissima.—A variegated variety, dense and compact in habit, having its leaves striped with straw colour, and sometimes whitish. As the variegation is constant, it is a very useful as well as a highly ornamental shrub.

It was introduced by Messrs. Fisher, Son, and Sibray, of the Handsworth Nurseries, near Sheffield.

Taxus baccata erecta.—A variety with slender upright branches, growing closely together, giving the tree a column-like form. The leaves are two-rowed, like those of the species.

Taxus baccata ericoides is one of the smallest varieties of the common Yew. It is a low shrub with slender branches, clothed with small heath-like foliage.

Taxus baccata fastigiata.—A very distinct variety, readily disguished from the species by its upright mode of growth and deep green leaves, which are not distichously arranged like those of the common Yew, but are scattered around the branchlets. It is the Irish Yew of gardens.

The Irish Yew originated from a plant accidentally found on the mountains of Fermanagh, near Florence Court, more than a century ago. The original tree is a female, so that the thousands of plants sprung from it are berry-bearing, a circumstance that greatly enhances the ornamental qualities of this shrub during the autumn months.

The following account of the origin of the Irish Yew is taken from the *Gardeners' Chronicle* for 1873, p. 1336, where it is reprinted from the *People's Journal*, as it appeared in one of a series of chapters entitled, "A Visit to the Eastern Necropolis" (at Dundee), by a writer under the *nom de plume* of "Norval," dating from Rossie Priory. It will be seen that the account contains an apt illustration of one of the purposes for which the Irish Yew is much planted:—

"Near by our place is a grave marked by a small and solitary Irish Yew, and nothing more. I know not who had been laid under it. That dark green 'mournful Yew,' however, serves a purpose in some hearts. Here and there in the Necropolis are to be seen similar monu-

* W. Barron, in *The Garden*, vol. ix., p. 341.

ments breaking the monotony of the grassy ranges. Each of them seems to have a sad story in its custody. The dark Yew has long been adapted as a favourite tree for shading the ground of our dead. The Irish Yew, or Florence Court variety of the Yew, has in a special manner become the most prominent and distinguished of the family. The history of the Irish Yew may be of interest to many. Here it is, and I quote from the MS. in possession of Lord Kinnaird—'Above one hundred years ago, Mr. Willis, farmer, of Aghenteroark, in the parish of Killesher, county of Fermanagh, found upon his farm on the mountains above Florence Court, two plants of this tree. These he dug up, and planted one in his own garden. He took the other down to his landlord at Mount Florence, where it was planted. The tree that was planted in his own garden remained there till the year 1865, when it died. The other is still alive at Florence Court, and is the one from which the millions of plants now distributed in all parts have sprung. The first cuttings were given by my father, the Earl of Enniskillen, to Messrs. Lee and Kennedy, then the largest Nurserymen about London.' Signed, Enniskillen, Rossie Priory, September 8, 1867."

Fig. 62.—The original Irish Yew at Florence Court.

That the Irish Yew is a sport of the common Yew is proved by the seedlings raised from it nearly always reverting to the common type.

Occasionally intermediate forms appear, some of which have a tolerably distinct character, and have been distributed under such names as *cheshuntensis*, *columnaris*, *intermedia*, *compressa*, &c.

Our engraving, from a photograph kindly sent to us by the Earl of Enniskillen, represents the original Irish Yew at Florence Court.

Among the variegated forms the following are distinct:—

Taxus fastigiata argenteo-variegata has many of its terminal growths creamy-white, and leaves striped and marked with the same colour scattered over the whole plant.

Taxus fastigiata aurea is analogous, as regards the colouring of its foliage, to the golden variety of the common form; the young growth and leaves being of a deep golden-yellow.

Taxus fastigiata aureo-marginata has the foliage of the current season edged with bright golden-yellow, which changes to light green as the growth of the succeeding season progresses.

This variety originated in the Nursery of Messrs. Fisher, Son, and Sibray, at Sheffield.

Taxus baccata fructu-luteo differs in nothing from the common Yew, except in the colour of its fruit, which is bright golden-yellow. When covered with berries it is very ornamental.

The yellow-berried Yew is of Irish origin. It appears to have been first discovered by a Mr. Whitlaw, of Dublin, about 1817, or before, growing on the lands of the Bishop of Kildare, near Glasnevin; but it seems to have been neglected till 1833, when it was noticed in the grounds of Clontarf Castle, whence cuttings were distributed.*

Taxus baccata nana.—A dwarf dense shrub, rarely growing more than 2 or 3 feet high, but spreading considerably in proportion to its height. The leaves are smaller, and darker in colour, than those of the common kind.

Taxus baccata nigra.—A vigorous-growing variety, of spreading habit. The upper surface of the leaves is darker than in the common kind, while the under side has a bluish glaucous tint, whence it has obtained the name of Blue John.

* Loudon, *Arb. et Frut.*, p. 2068.

Taxus brevifolia.—The Californian Yew differs considerably in aspect from the common Yew; its growth is more open, and its foliage lighter and more feathery. Its height varies according to soil and situation, from 25 to 50 feet, and even more, being greatest along the courses of the rivers, and less in the more exposed places on the mountain sides. The leaves are shorter and narrower than those of the common kind, being not more than from half to three quarters of an inch long with a short twisted footstalk, abrupt or mucronate at the apex, and yellowish-green in colour. The habit of the young plants growing in England is very distinct; the branches increase in length as fast as the leader increases in height, giving the plant the outline of a cone with a base broader than the height.

Habitat.—North-west America, from the Mexican boundary to British Columbia, chiefly on the mountain ranges and on the banks of rivers. It attains its greatest developement in the valley of the Willamette.

Introduced by us in 1854, through our collector, William Lobb.

The specific name *brevifolia*, refers to the leaves. This Yew should not be confounded with *Taxus adpressa*, which has for one of its synonyms *T. brevifolia* (Hort.).

Taxus canadensis.—The Canadian Yew is a much smaller tree than the European species, rarely forming an erect trunk like the common Yew, or exceeding 15 feet in height. "As it grows about the great Lakes it is a low trailing shrub, forming a thick and tangled undergrowth, covering the surface of the Pine and Hemlock forests, seldom growing more than 3 or 4 feet from the ground." *. The leaves are shorter, narrower, and paler in colour, and the berries smaller than those of the European Yew.

Habitat.—Canada and the north-eastern States, extending southwards only along the Alleghanies. It prefers moist banks and hills near streams, especially in the shade of evergreen trees.†

Introduced about the year 1800.

The Canadian Yew is commonly known as the ground Hemlock in America.

* Dr. Newberry, *Pacific Railway Report*, p. 60.

† Dr. A. Gray, *Flora of Northern States*, p. 474.

The Florida Yew *(Taxus floridana)* is a small tree 10 to 20 feet in height; it is found only on the banks of the Apalachicola river, and is still imperfectly known.

Taxus canadensis variegata is a far more ornamental plant than the preceding; the leaves of the young growth are margined with yellowish-white, which becomes fainter by age, and finally gives place to the natural green of the species during the growth of the following season.

Taxus canadensis Washingtonii is a rather vigorous-growing variety, with longer leaves, having their tips and part of the upper surface of a bright golden-yellow. It is one of the handsomest of the variegated Yews.

Taxus cuspidata as seen in the forests of Jesso, is generally solitary. It attains a height of from 30 to 40 feet, with a trunk from 1½ to 2 feet in diameter. The branches are spreading, and the general aspect is less dense than the common Yew and with a somewhat more irregular outline. The leaves are broader, more abruptly pointed, more leathery in texture, and lighter in colour than those of the European species. On the branchlets the distichous or two-rowed arrangement predominates, but on the older growth and upright branches, the leaves are scattered as in the Irish Yew.

Habitat.—Japan, in the island of Jesso, and in cultivation throughout the country.

II.—CEPHALOTAXUS *(Siebold).* The Chinese Yew.

A small group of Taxads inhabiting northern China and Japan, was discovered between forty and fifty years ago by Dr. Siebold and Mr. Fortune, and introduced by them under the name of Cephalotaxus. Three species or forms are at present known, one indigenous to China, one to Japan, and one occurs in both these countries. They are straggling undershrubs, having the following characters:—

Primary branches whorled and spreading; the secondary ones produced laterally only; the leaves linear, two-rowed, with a short footstalk, and sharply pointed; flowers dicœcious; the

fruit in clusters of twos and threes, each with a single seed enclosed in a fleshy envelope about the size of a damson or wild plum, and ripening the second year.

The Japanese species are found growing abundantly on the mountains of Nippon and Jesso, at 1,000 to 2,000 feet elevation, and always below *Thuiopsis dolabrata*. They are shapeless bushes, seldom exceeding 6 to 8 feet in height, and form a part of the undergrowth of the woods composed of Maples, Cryptomeria, Abies, &c.

In Great Britain the Cephalotaxi are tolerably hardy, but their growth is slow. They should be planted in the shade of other trees where their foliage retains its deep glossy green as well as its persistency. Under full exposure to the sun the leaves often become discoloured, and manifestly unhealthy; they soon fall off, and the plant has a bare and unfurnished appearance. Besides being shaded the Cephalotaxi should also be sheltered from cold winds, and the soil in which they are planted should be moist, but sufficiently drained. Under these conditions alone do they appear to thrive in this country.

Cephalotaxus from κεφαλή (kephalé), "head" and τάξος (taxos) "the Yew;" in reference to the staminate flowers, which are small globular heads, with short footstalks, produced from the axils of the leaves.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
CEPHALOTÀXUS DRUPÀCEA (*Siebold*)	*Cephalotaxus Fortunei fœm* (Hort.)	The Plum-fruited Cephalotaxus	China and Japan	6 to 8
FORTÙNEI (*Sir W. Hooker*)	,, ,, *mas* (Hort.)	Fortune's Cephalotaxus	China	6— 8
PEDUNCULÀTA (*Siebold*)	*Taxus Harringtoniana* (Knight)	Lord Harrington's Yew	Japan	6— 8
,, fastigiata (*Carrière*)	,, *japonica* (Loddiges)	...	Japan	6— 8
	Podocarpus koraianus (Gordon)	...	...	6— 8

Cephalotaxus drupacea.—A straggling shrub, with horizontal frondose branches, and with the secondary branches and branchlets short, stiff, and quite flat. The leaves are from three-fourths of an

inch to 2 inches long, arranged in two opposite rows, regularly opposite, coriaceous in texture and yellowish-green in colour. It was discovered by Mr. Fortune, in North China, in 1849.

Cephalotaxus Fortunei has the finest foliage of the three kinds in cultivation. The leaves are upwards of 3 inches long, gradually tapering to a point, distinctly one-nerved, dark green above, much lighter beneath; the bark of the young growth is of the same colour as the under surface of the leaves and furrowed.

Introduced from North China by Mr. Fortune at the same time as the preceding.

Cephalotaxus pedunculata.—A shrub, with spreading branches, clothed with distichously arranged foliage; the leaves are from 1 inch to 2 inches long, bright green above and marked with two broad glaucous lines beneath.

It was introduced from Japan in 1837 under the name of *Taxus Harringtoniana*, by which name it is often known in collections.

Cephalotaxus pedunculata fastigiata.—A very distinct and ornamental variety of the preceding, with the habit of the Irish Yew, and showing a similar departure from the normal form in the arrangement of the leaves. The branches are as erect as the trunk, and the leaves are scattered or spirally arranged around them. It was introduced from Japan in 1861.

This plant, which has now become common in British gardens, is better known among horticulturists as *Podocarpus koraianus* or *Taxus japonica* than the name under which we have described it. That it is no other than a variety of *Cephalotaxus pedunculata*, M. Carrière has clearly demonstrated.* He remarks that "the doubts I expressed in my former edition relative to the specific value of *Podocarpus koraianus* are realised, and, as I suspected, instead of a Podocarp it is an accidental fastigiate form of *C. pedunculata*. I have seen a strong plant of this variety which, at 2 feet from the ground, had developed lateral branches with distichous foliage, and which, at that point, had formed a verticil like a projecting stage, while the parts both above and below were quite upright." We have ourselves observed a similar case in Lady Rolle's Pinetum at Bicton:—An unusually fine and vigorous plant of *C. pedunculata fastigiata* has several branches growing in

* *Traité Général des Conifères*, p. 717.

a horizontal direction, with distichous foliage like that of the species, while the upright branches have scattered foliage like that of the Irish Yew.

III.—TORREYA *(Arnott)*. The Fetid Yew.

Torreya is a genus of evergreen trees including three or four species, each of which is restricted to a locality of limited extent, in countries widely remote from each other. The Torreyas possess the following essential characters :—

> Branches spreading, the primaries frequently in whorls ; branchlets produced laterally only, and opposite, or nearly so ; leaves larger and longer than those of the common Yew, distichously arranged in single rows, coriaceous, very rigid and sharply pointed; flowers dicœcious; fruit, a single seed enclosed in a fibrous fleshy envelope, of a greenish-brown colour when ripe.

The young foliage, when bruised, emits a disagreeable rue-like odour, whence, in America, the Torreyas are called the fetid Yews. The wood, although hard and probably very durable, is not applied to any economic purpose ; the trees of each species are comparatively few in number, a significant fact in their present history.

The Torreyas do not thrive well in Great Britain. In some places they are growing into moderate-sized bushes, but more frequently their growth is very slow ; the habit they assume possesses little that is attractive, and is quite different from the handsome trees they become in their native countries.*

In their scientific aspect the Torreyas possess a deep interest. Their distribution shows that they form part of the arborescent vegetation of those regions in which the Californian Sequoias and their nearest relatives, the Deciduous Cypress and the Chinese Water Pine, are prominent members, for where the one occurs the other is present. The Torreyas, doubtless, attained their greatest development during the same geological epoch as that in which their gigantic neighbours flourished. The race appears to be doomed, although the species may be preserved indefinitely by the hand of man. Dr. Asa Gray, pointing out the peculiarities in the geographical distribution, and the natural causes that are at work to produce the gradual extinction of the great trees, thus refers to the Torreyas.† "There is another set of three or four peculiar trees, in this case of the Yew family, which has the

* M. Carrière is of opinion that this is owing to the plants having been raised from cuttings instead of from seed. *Tr. Gen. de Conifères*, pp. 725, 726.

† *See* page 208.

same peculiar distribution as the Sequoias and their nearest relatives. The genus Torreya was founded upon a tree discovered about thirty-five years ago (now forty), in northern Florida. It is a noble Yew-like tree, and very local, being known only for a few miles along the shores of a single river. Another species of Torreya is a characteristic tree of Japan, and the same, or one nearly like it, inhabits the Himalayas. There is only one more species of Torreya, and that is a companion of the Redwoods of California; it is a tree locally known under the name of the Californian Nutmeg. Moreover, the Torreya of Florida has growing with it a Yew tree, and the trees of that grove are the only Yew trees of eastern America, for the Yew of our northern woods is only a decumbent shrub. The only other Yew trees in America grow with the Redwoods and the other Torreya in California. A Yew tree equally accompanies the Torreyas of Japan and the Himalayas, and these are apparently the same as the common Yew of Europe. So we have three groups of trees of the great Coniferous Order which agree in this peculiar geographical distribution; the Redwoods and their relatives, which differ widely enough to be termed a different *genus* in each region; the Torreyas, more nearly akin, merely a different *species;* the Yews, probably all of the *same* species. *

Torreya, named after Dr. John Torrey, "The Nestor of American Botany," originator and author of portion of the valuable work, *Flora of North America.*

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
TÒRREYA GRÀNDIS (*Fortune*)	*Caryotaxus grandis* (Henkel)	The tall Torreya	China and The Himalayas†	40 to 50
MYRÌSTICA (*Sir W. Hooker*)	*Torreya californica* (Torrey)	The Californian Nutmeg	California	40 — 50
	Caryotaxus myristica (Henkel)			
NUCÍFERA (*Siebold*)	*Taxus nucifera* (Kæmpfer)	The Japanese Torreya	Japan	40 — 60
	Caryotaxus nucifera (Zuccarini)			
TAXIFÒLIA (*Arnott*)	*Taxus montana* (Nuttall)	The fetid Yew	Florida	30 — 40
	Caryotaxus montana (Henkel)			

* Dr. Asa Gray, *Address to the American Association for the Advancement of Science*, 1872.
† *Idem.*

Torreya grandis.—A tree of Yew-like aspect, from 40 to 50 feet high, with erect trunk and spreading branches. The leaves are about an inch long, slightly convex above, and marked beneath on each side of the keel by two furrows of a paler colour. The fruit is plum-shaped, about three-quarters of an inch long.

It was introduced from northern China, by Mr. Fortune, in 1847. It is scarcely distinguishable from the Japanese *Torreya nucifera.*

Torreya myristica.—A handsome tree attaining a height of 50 feet in the ravines of the Sierra Nevada, in California, where it was discovered by our collector, William Lobb, in 1851. It is easily distinguished from the other species by its longer leaves, which are often two or more inches in length, nearly flat, deep glossy green above, paler beneath, with a sunken line on each side of the midrib. The fruit is elliptic, about 1½ inch long.

It was introduced by us in 1851.

Torreya nucifera.—A pyramidal tree from 40 to 60 feet high, with the aspect of *Abies firma.* The leaves are about an inch long, and present much the same characters as those of *T. grandis,* described above. The fruit is egg-shaped, about an inch long. It is found sparingly on the mountains, and also on the west coast of Nippon, Japan.

It was introduced into European gardens about forty years ago, by Dr. Siebold.

Torreya nucifera, as it grows on the western coast of Nippon, is somewhat different from the inland tree. The trunk is stouter, attaining a diameter of from 2½ to 3 feet, the head more dense, and instead of the pyramidal form of *Abies firma,* it has a rounded top, not unlike that of the older Yews of this country; the leaves are also shorter, narrower, and more pointed. In this situation it has for its surroundings Camellias, Diospyrus Kaki, and other well known half-hardy garden favourites.

Torreya taxifolia.—The Fetid Yew of Florida, the first species of Torreya known, was discovered so recently as 1838. It is a handsome tree 40 feet high, clothed with very stiff leathery leaves, having sharp spiny points, and emitting a disagreeable odour when bruised. The fruit is obovate in shape, and about an inch long. It is rather tender in the climate of Great Britain.

The wood of this species is said to be exceedingly durable, and also odoriferous, especially when burned.

IV.—GINKGO. The Maiden-Hair Tree.

In the Ginkgo or Salisburia we have a remarkable exception to the Yew-like aspect which characterises all the other hardy Taxads. So greatly does the Maiden-Hair Tree differ from all other Coniferous trees, that its affinity to them would scarcely be suspected on superficial inspection. An examination of the flowers, and especially of the fruit, and comparing them with the same parts of the common Yew, will show, however, that the Ginkgo belongs to the same tribe, although an isolated member of it.

The fruit or berry is by no means common in this country, for the Ginkgo is dicœcious, and the greater number of the large trees growing in England are staminferous or males. Fertile trees are still rare, and both kinds require in our climate to attain a considerable age before they produce flowers.

Not much can be said of the economic value of the Maiden-Hair Tree. The wood is yellowish-white, with a fine close grain, and moderately hard. It is easy to work, receive a fine polish, and resembles in its general appearance citron wood; it is more solid and strong that the ordinary white woods of Europe. The Ginkgo is peculiar among Coniferous trees for the absence of resinous secretions. In China and Japan it is cultivated for the sake of its fruit, the nuts being much esteemed; and in Japan, in Kæmpfer's time, these formed part of every entertainment.

The Ginkgo is of geological antiquity. In the Miocence period it included several species or forms which were spread over the greater part of the northern hemisphere in company with the Glyptostrobus and Liriodendron, trees that are still associated with it in its present habitat.

Ginkgo* is the Chinese name, meaning "deciduous." This name was adopted by Linnæus, and by priority of application, should be preferred to Salisburia, the scientific name hitherto generally current in this country. It is called the Maiden-Hair Tree from the resemblance of the leaves in shape to the pinnules of *Adiantum Capillus-Veneris*, the Maiden-Hair Fern. In France it is popularly known by the eccentric name of *L'arbre aux quarante écus.*† There is only one species at present known.

* It is called "Itcho" by the Japanese.

† For the origin of this curious name, *see* Loudon, *Arb. et Frut.*, p. 2096.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
GINKGO BILÒBA (*Linnæus*)	*Salisburia adiantifolia* (Smith)	The Maiden-Hair Tree or Ginkgo	China and Japan	70 to 100
,, macrophỳlla (*Hort.*)	,, *biloba laciniata* (Hort.)	The large-leaved Maiden-Hair Tree	Garden variety	

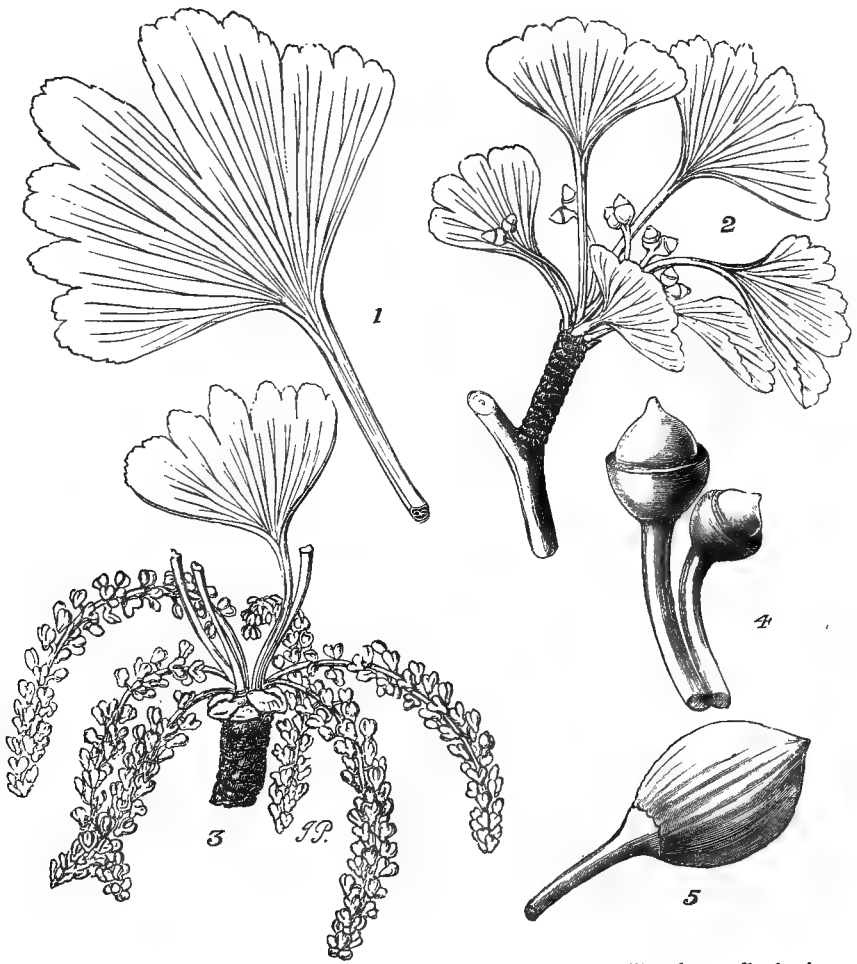


Fig. 63.—*Ginkgo biloba*. (1) Leaf of sterile branch; (2) of fertile branch; (3) male, or pollen-bearing flowers; (4) female flowers; (5) fruit.

Ginkgo biloba (syn. **Salisburia adiantifolia**) is one of the most

remarkable and distinct deciduous trees that adorns the gardens and parks of Great Britain. Its light and airy aspect, its peculiar foliage, and the imposing dimensions it attains render it also one of the most picturesque of trees. The following is Loudon's excellent description with one or two necessary corrections :—

"In England, where it is in a favourable soil and situation, it rises with a straight erect trunk, regularly but not formally furnished with branches, at first inclined upwards, but as they become older taking a more horizontal direction, so as to form a regular conical and somewhat spiry topped head. The leaves resemble in form those of the Maiden-Hair Fern; they are of the same colour and texture on both sides, and in their smoothness and parallel lines are like those of a monocotyledonous plant. They are somewhat triangular or fan-shaped, disposed alternately, wedge-shaped at the base, with stalks as long as the disc; abrupt at the upper extremity, those on the barren branches cloven or notched there in a manner peculiar to this tree and some species of Ferns, but on the fertile branches the notch is absent and the outer edge merely crenulate; they are of a fine yellowish-green with numerous parallel ribs. The pollen-bearing catkins are sessile, about 1½ inch long, and of a yellowish colour; the ovule-bearing catkins are produced in pairs on long foot-stalks, and are enclosed in a sort of cup produced by a dilatation of the summit of the peduncle. The fruit consists of globular or ovate drupes about the size of a walnut, of a yellowish-green when ripe, and enclosing a kernel about the size of a hazel nut, which has a flavour something like that of an almond."

Habitat.—Northern China. It is frequently met with in Japan, where it is most probably an introduced plant.

Introduced into England about 1754. It has been made known to Europeans sixty years previous by Kæmpfer.

Ginkgo biloba macrophylla has much larger leaves than the species; they are nearly semicircular, and often measure from 5 to 6 inches across; they are divided into two lobes by a cleft opposite the foot-stalks two-thirds the width of the leaf. The edges of the nerves are more jagged and the nerves radiating from the petiole more prominent than in the species.

This fine variety originated at Avignon, in France, about the year 1850.*

A variegated and a pendulous variety have been brought under the notice of horticulturists, the former having some of its leaves striped with pale yellow, and the latter having its terminal branchlets pendulous. The colouring of the *variegata* is indistinct, and the weeping habit of the *pendula* adds nothing to the beauty of the normal form, but rather detracts from it. These varieties are both of Continental origin.

V.—SAXE-GOTHÆA (*Lindley*). PRINCE ALBERT'S YEW.

Saxe-Gothæa is one of a small group of Coniferous trees indigenous to the southern portion of the Cordilleras of the Andes, which are distinguished from their northern congeners by several peculiarities of structure and aspect. In the present subject the singularity of structure is seen chiefly in the fructification, which includes forms peculiar to several distinct genera. According to Dr. Lindley, Saxe-Gothæa has the male flowers of a Podocarp, the female flowers of a Dammara, the fruit of a Juniper, the seed of a Dacrydium, and the general aspect of a Yew. It is monœcious, but the male and female flowers are produced on different branches.

Saxe-Gothæa was named in compliment to the late Prince Consort.

SCIENTIFIC NAME.	Popular Name.	Habitat.	Height in Feet.
SAXE-GOTHÆA CONSPICUA (*Lindley*)	*Prince Albert's Yew* ...	Southern Chili and Patagonia	15 to 25

Saxe-Gothæa conspicua is a low tree, with spreading branches densely clothed with foliage of a lighter green than that of the common Yew. The leaves are scattered, but sometimes partially two-rowed on the branchlets, about 1 inch long, tapering, acuminate, and pointing forwards, many of them slightly falcate, with a single salient middle nerve above, and marked with two glaucous lines beneath.

Habitat.—The Andes of Valdivia and Patagonia.

Introduced by us in 1849 through our collector, William Lobb.

The Saxe-Gothæa is but moderately hardy in England; its growth

* Carrière, *Traité Gén.*, p. 713.

is slow, its habit unsymmetrical, and it will only live in sheltered spots where there is good soil. Its claim to a place in the garden rests on its distinct character and the scientific interest attached to it.

VI.—PRUMNOPITYS (*Philippi*). The Plum-fruited Yew.

It is not without hesitation that we retain the separate generic rank assigned to this beautiful Taxad by Professor Philippi, of Santiago, in which he is followed by Carrière,* but not by Parlatore,† by whom it is included in the Podocarps, to which it is undoubtedly very closely allied. The habit the Prumnopitys assumes in this country, and its Yew-like foliage being quite distinct from every Podocarp in cultivation, we have thought it best to adhere to the name by which it is universally known among British horticulturists.

Prumnopitys, from προῦμνος (proumnos), "the wild plum," and πίτυς (pitys), "the pine tree."

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PRUMNOPITYS ELEGANS (*Philippi*)	*Podocarpus andinus* (Pœppig)	The Plum-fruited Yew	Valdivia, Chili	40 to 50

Prumnopitys elegans on its native mountains resembles in habit a well-grown specimen of *Abies Douglasi*. It attains a height of from 40 to 50 feet, well furnished with branches, the lower ones drooping, often sweeping the ground and hiding the trunk of the tree with a peculiarly rich and abundant foliage. The leaves are linear, flattened from half to three quarters of an inch long, subdistichously arranged, deep bright green above and slightly glaucous beneath. The fruit resembles in form and size, the berry of an ordinary white grape, but in structure that of a cherry, the kernel being contained in a hard stone or nut surrounded by a soft fleshy pulp enclosed in a tough rind. The ripe fruit, both fresh and dried, is eaten in large quantities by the natives, and has by no means a disagreeable flavour. The wood is hard, dark red in colour, and susceptible of a high polish.

Habitat.—The Andes of Valdivia, Southern Chili, at from 4,500 to 6,000 feet elevation.

* *Traité Général des Conifères*, p. 682. † *Prod.*, xvi., p. 519.

Introduced by us in 1860 through our collector, Richard Pearse.

Prumnopitys elegans has proved moderately hardy in Great Britain. It grows fairly in good soils, in sheltered situations, where it assumes the form of a dense shrub, of pyramidal or columnar outline.

VII.—PODOCARPUS. *(L'Héritier).*

The genus Podocarpus includes an unknown number of species, which, under considerable diversity of form and aspect, are met with in almost every part of the torrid zone, the extra tropical regions of Australia, New Zealand, and the South Sea Islands, China, Japan, &c. They are all trees or shrubs more or less distinguished by their leathery deep green leaves, which in most of the species are linear, with a prominent middle nerve, and not unfrequently from 6 to 9 inches long, and by their plum-like fruit enclosing a single kernel or seed.

Only three or four species are sufficiently hardy for cultivation in this country, and these require warm and sheltered spots. Other species are noteworthy for their great value as timber producing trees in their native countries, as the Totara Pine of New Zealand, the *Podocarpus cupressinus* of Java, &c.

Podocarpus from πούς, ποδὸς (pous, podos) "a foot," and καρπὸς (karpos) "fruit;" the berries or fruit of the Podocarps have footstalks.

Scientific Name.	Synonyms.	Popular Name.	Habitat.	Height in Feet.
PODOCÀRPUS ALPÌNUS *(Brown)*	... ...	The Alpine Podocarp	Victoria and Tasmania	10 to 12
CHILÌNUS *(Richard)*	*Podocarpus salignus* (Don)	The Chilian Podocarp	Chili	40 — 60
CHINÈNSIS *(Wallich)*	*Taxus chinensis* (Roxburgh)	The Chinese Podocarp	China	
MACROPHŸLLUS *(Don)*	,, *macrophylla* (Thunberg)	The long-leaved Podocarp	Japan	40 — 50
NAGEÌA *(Brown)*	*Nageia japonica* (Gaertner)	The Japanese Laurel	Japan	Variable
NUBÌGENUS *(Lindley)*	*Podocarpus nubicolus* (Makoy)	...	Chili and Patagonia	
TOTÀRA *(Don)*	... ...	The Totara Pine	New Zealand ...	60 — 80

Podocarpus alpinus.—A shrub of spreading habit, with slender procumbent branches and foliage much resembling that of the Totara Pine. The leaves are linear, about half an inch long, pungent, and marked with a prominent rib on the under side.

Habitat.—Mounts Wellington and Marlborough in Tasmania, at from 3,000 to 4,000 feet elevation. Also on the Australian Alps in Victoria.

Podocarpus chilinus.—A medium-sized tree from 40 to 60 feet high, well furnished with branches and foliage. The leaves are from 2 to 3 inches long, distant, tapering at both ends, quite smooth, deep glossy green above and paler beneath; they are spirally arranged on slender branchlets, and (in England) appear to be persistent two seasons, falling off in the third, leaving a scar on the bark of the mature wood.

Habitat.—The Andes of Chili and Peru, very abundant in the former country.

Introduced into Europe in 1853.*

Podocarpus macrophyllus.—A tree from 25 to 40 feet high, affording useful timber. In England, in sheltered spots, it is a beautiful and distinct evergreen shrub, with numerous branches clothed with rather pale green leaves 4 inches long and quarter of an inch broad, tapering at the base and obtusely pointed at the apex, but every branch also having leaves acutely pointed, the points having a withered appearance. The nerve along the middle is raised on both sides of the leaf, the margin slightly raised on the under side only.

Habitat.—Japan, in the neighbourhood of Yedo and Nagasaki.

Introduced in 1804.†

Podocarpus nubigenus.—A remarkable tree of considerable size, clothed with deep green foliage. The leaves are thick, rigid, leathery in texture, from 1 inch to 1½ inch long, and one-eighth of an inch broad, and marked on the under side on each side of the rib with a more or less glaucous band. The fruit is oblong, and on shorter footstalks than in most Podocarps.

Habitat.—Valdivia and Chiloe in Chili, and the Andes of north Patagonia.

Introduced by us in 1849, through our collector, William Lobb.

* Carrière, *Tr. Gén. des Con.*, p. 650. † Loudon, *Arb. et Frut.*, p. 2100.

Although found at considerable elevations on the Andes of Patagonia, in company with *Libocedrus tetragona*, *Fitzroya patagonica*, and *Saxe-Gothæa conspicua*, this remarkable Podocarp may thus far be considered as having failed to become acclimatised in Great Britain, a circumstance to be regretted, in consequence of the very distinct character of the plant, and the new feature it would introduce into our shrubberies.

Podocarpus chinensis.—A shrub or small tree, with erect trunk, short branches and slender green branchlets furnished with linear-lanceolate leaves, from 2 to 3 inches long. It is abundant in south-eastern China; it is also met with in Japan under cultivation. Living specimens are now rare in Great Britain.

Podocarpus Nageia.—A beautiful Japanese tree, often from 40 to 50 feet high, with erect trunk, furnished with alternate and opposite branches, rather slender, and sometimes pendulous. The leaves are broadly ovate, attenuated at the point, and slightly glaucescent. It is one of the trees first made known to Europeans by Kæmpfer so long ago as 1690, but not introduced till the present century. From the shape of the leaves it is sometimes called the Japanese Laurel. It is rather tender.

Podocarpus Totara is the Totara Pine of New Zealand, much valued by the colonists on account of its excellent timber. It is the typical tree of the central and south-eastern portion of the Northern Island, where it attains a height of from 60 to 100 feet. It has long slender branches, rather twiggy at their extremities, and clothed with rigid sharp-pointed leaves, varying from one-third to one inch in length, and of a pale yellowish-green. The species is now quite rare in England owing to its inability to stand the severity of some of our winters.

Dacrydium Franklinii.—The Huon Pine of Tasmania. A tall tree, often attaining a height of 100 feet, with a trunk proportionately large. The branches are short, and grow horizontally from the trunk; the branchlets numerous, slender, pendulous, and clothed with scale-like imbricated leaves like those of an Arbor Vitæ or Cypress. It is moderately hardy, and is not unfrequently met with in British collections. The timber of the Huon Pine is close grained, durable, and has an aromatic fragrance.

Dacrydium cupressinum.—A pyramidal tree, with weeping branches and pale green foliage. The leaves are small and closely imbricated all round. "It is the typical tree of the western district of the North Island, New Zealand. It is usually from 60 to 100 feet high, with a trunk 3 to 5 feet in diameter. The timber is largely used in the colony for building and for other constructive purposes."* It is rather tender in England.

* Captain C. Walker, *Report on New Zealand Forests.*

PART III.

THE VARIOUS PURPOSES

FOR WHICH THE

CONIFERÆ ARE PLANTED.

The various purposes for which some of the most important Coniferous trees and shrubs, described in the preceding pages, are best adapted in their relation to Horticulture have been already alluded to in the notes appended to the descriptions. We now proceed to enumerate these purposes in a connected form with a view of giving lists of the trees and shrubs suitable for each, or from which a selection may be made.

I.—THE PINETUM.

The Pinetum, in its comprehensive sense, is a complete collection of living specimens of all the Coniferous trees and shrubs known; but as such a collection is impracticable in this country owing to climatal causes, the term has acquired a restricted meaning, and is applied to collections, more or less complete, according to the localities in which they are formed, of all the kinds that will live in the open air in Great Britain.

The object of forming a Pinetum may be (1) for studying the Coniferæ in their scientific aspect, for which end the various trees and shrubs would be best arranged according to their systematic

places; or (2) for artistic effect, such as the formation of an out-of-doors winter garden, &c., when the arrangement would be that which is most pleasing to the eye, or according to the taste of the planter.

The planting of Pineta originated in the beginning of the present century. One, the first formed in this country, was that of the Messrs. Loddiges, at Hackney, which was begun in 1816, but which has now long since disappeared and the ground occupied by it built upon. During the twenty-five years immediately following, many others were formed partly through the exertions of Mr. Loudon, who was an earnest advocate for them, and partly by the examples afforded by the Duke of Devonshire, at Chatsworth; the Duke of Bedford, at Woburn; Lady Rolle, at Bicton; Lord Grenville, at Dropmore; the Earl of Harrington, at Elvaston; W. R. Baker, Esq., at Bayfordbury; T. Gambier Parry, Esq., at Highnam Court, and others. Of late years the practice has fallen into disuse, which is much to be regretted, not only because numerous introductions of new and beautiful kinds have added greatly to the resources at command, so that both variety and effect can be increased in a corresponding degree, but also the knowledge and experience of Coniferous plants in Great Britain is so much enlarged that the mistakes and errors which but too frequently occurred in the older plantations, may now with certainty be avoided.

Fine collections of Coniferæ, including most of the recent introductions, have, however, been formed by noblemen and gentlemen in different parts of the country, among which we may mention that of Earl Ducie, at Tortworth Court; Viscount Holmesdale, at Linton Park; W. Parker Hamond, Esq., at Pampesford Hall, Cambridge; the Earl of Courtown, at Courtown, county Wicklow, Ireland; J. M. Livesey, Esq., at Stourton Hall, Horncastle; Charles Lucas, Esq., at Warnham Court, Horsham, &c., &c.

It will be useful to recapitulate in this place, some obvious general principles that should be kept in view when planting Coniferæ for ornamental purposes, and which are alike applicable to the formation of a Pinetum, a smaller collection, or the selection of a spot for a single specimen.

Many of the Fir and Pine tribe grow naturally and attain their finest developement on the slopes of mountains where the soil is generally very shallow, and beneath which is the solid rock. Although the rain-fall in such places is usually very heavy, no water can settle or stagnate in loose soil on steep hillsides. It is essential, therefore, that the ground in which it is proposed to plant the trees belonging to this tribe, should be thoroughly drained, so that water cannot stagnate at the roots. If the subsoil does not permit the free escape of water, artificial drainage should be resorted to. And, generally, all

Conifers thrive in well-drained, but not in too dry, soils. There are a few exceptions to be hereafter specified.

Many of the Silver Firs, although occurring in lower latitudes than the Spruces and some of the Pines, have to endure in their native country, from accidents of situation, a longer and more severe winter and also a hotter summer than in England. Most of these in a mild season, are prone to start into growth early, and are thence liable to injury, often of a permanent kind, by late spring frosts. A rather exposed situation is best for these, such as a north-west aspect, but at the same time protected from north-east and easterly winds. The Himalayan Abies, several of the finest Californian species, and those from south-eastern Europe and Asia Minor frequently suffer from the inequality of our climate compared with that of their habitats.

Those Conifers whose habitat is in close proximity to the ocean, as some of the Californian, the Japanese, and South European species, require protection from north, north-east, and east, either by a screen of deciduous trees, or by a belt of the hardy European and common North American Conifers. A loamy soil, moist and deep, is the most suitable for them.

Nearly all the Cypress tribe, with the exception of the Thuias and some of the Junipers, are natives of countries having a higher mean temperature than Great Britain. They are liable to injury by piercing north-east and easterly winds, from which they should be protected. The true Cypresses, (*Cupressus Lawsoniana*, and *C. nutkaënsis* with their varieties excepted), the Libocedri of Chili and New Zealand, the Athrotaxes, and some others, must always have sheltered situations, or such as escape the worst effects of the severe frosts that occur at intervals in this country.

The lower branches and foliage of Conifers soon die and fall off when they are in contact with other trees or objects, or with each other. No Coniferous tree or shrub retains a symmetrical form unless it is in a situation where the air can circulate freely on all sides of it. To secure good specimens, in addition to the conditions stated in the preceding paragraphs, it is indispensable that a sufficient space should be allowed to each tree or shrub to admit of a free circulation of air around it. The lengths attained by the lower branches of some of the finest specimens of the most important ornamental Conifers cultivated in Great Britain, are given in the notes following the descriptions; from these dimensions the minimum of space to be allowed for each can be deduced.

No Coniferous tree or shrub thrives or lives long under the influence of the smoke of large towns. The common Yew and the Chinese Arbor Vitæ appear to possess the greatest power of endurance of a smoky atmosphere, but these eventually succumb.

The further cultural aids to Coniferæ depend much upon local cir-

cumstances and the purposes for which they are planted. In woods and plantations they are "top-dressed" by Nature's own processes—the fall of the leaf, the droppings of birds and other animals, &c. But when they are planted for the decoration of the lawn and pleasure-ground, these natural top-dressings are frequently, if not constantly removed before they are in a condition to afford nutriment to the trees around and under which they lie. And not only so, the surface of the ground above the roots is usually covered with close cut turf which assimilates to itself all, or by far the greater portion of, the nutritive ingredients of the surface soil, and at the same time renders it impervious to sun and air. In these cases top-dressings may be applied with advantage.

"The best and safest of all top-dressings is one composed of turfy-loam from the surface of an old pasture, laid up to rot for two years before it is used. It is better to add nothing to it; some are fond of leaf-mould, and, at first sight, one might suppose that Nature's own top-dressing must be best. But it must be borne in mind that the quality of leaf-mould is very much modified by the mode of preparation, and Nature's method is not exactly ours. It is also most certain that, as *we* make and use it, it is generally more fertile of fungus than of root food, and these are always injurious to the roots of trees.

"The loam is cleaner, and in all respects better. It is also far more potent as well as the more durable food. Experience is altogether in favour of it, but one great difficulty is, it cannot always be had. In this case, the soil out of an arable field or kitchen-garden proves a good substitute for the loam. Four inches may be accepted as a useful safe average for depth of top-dressing. November is the best month for removing turf, where the roots are covered with it, and for applying top-dressing; but if the verdure under the trees is not considered indispensable, April or May would be best." *

The growth and well-being of Coniferæ are greatly influenced by the annual rainfall of the district in which they are situated (*see* page 12). It is thence self-evident that in dry seasons, as well as on naturally dry soils, the occasional soaking of the roots with pure water is beneficial.

II.—THE PARK.

All the larger Coniferous trees are appropriate subjects for Park scenery; but when a selection is desirable, it may be made from the following kinds:—

N.B.—The names in this and most of the lists that follow are

* Mr. D. T. Fish, in *Journal of Forestry* for July, 1880, in which the subject is treated in his usual thoroughly practical and efficient manner. It is with much satisfaction that we find Mr. Fish's experience and suggestions in perfect accord with our own.

given in the Order in which the Trees are described in Part II. Those marked (*) require a more or less sheltered situation.

Abies ajanensis
„ Alcoquiana
„ excelsa
„ orientalis
„ polita
* „ Smithiana
„ brachyphylla
„ cephalonica
„ concolor (lasiocarpa)
„ firma
„ grandis
„ magnifica
„ nobilis
„ Nordmanniana
„ numidica
„ pinsapo
„ sachalinensis
„ Veitchii
„ Albertiana
„ Douglasii
Larix europæa
Cedrus atlantica
* „ deodara
„ Libani

Pinus austriaca
„ densiflora
„ Pallasiana
„ pyrenaica
„ Jeffreyi
„ macrocarpa
„ ponderosa
„ Cembra
„ excelsa
„ Lambertiana
„ monticola
„ Strobus
*Araucaria imbricata
Wellingtonia gigantea
*Sequoia sempervirens
Taxodium distichum
*Cryptomeria japonica
„ Lobbi
*Cupressus macrocarpa
„ Lawsoniana
Thuia Lobbi (gigantea)
Taxus baccata
Salisburia adiantifolia.

III.—THE LAWN AND PLEASURE GROUNDS.

All the trees enumerated in the foregoing list are of symmetrical habit, and include the best that can be selected from among the larger Coniferæ, as single or isolated specimens, for large Lawns and Pleasure Grounds.

The following list includes select medium-sized and low Coniferous trees of symmetrical habit, also suitable as single or isolated specimens for the Lawn and Pleasure Ground.

Abies Engelmanni glauca
„ Hookeriana
„ Tsuga
Pinus contorta
„ Bungeana
„ Cembra
„ koraiensis

Pinus parviflora
Sciadopitys verticillata
Cryptomeria elegans
Cupressus Lawsoniana
„ „ argentea
„ „ erecta viridis
„ „ intertexta

Cupressus nutkaënsis
„ „ argentea variegata
„ thyoides variegata
Retinospora filicoides
„ obtusa
„ „ aurea
„ „ gracilis aurea
„ pisifera
„ plumosa
„ „ alba picta
„ „ aurea
Biota orientalis
Thuia occidentalis
„ Standishii
„ Vervaencana
Thuiopsis dolabrata
Libocedrus decurrens
Juniperus rigida
„ virginiana
„ „ glauca
„ chinensis mas
„ drupacea
„ thurifera
„ sphærica.

Coniferous trees and shrubs of fastigiate or upright habit and of dense growth, requiring but little room; suitable for the Lawn, the Terrace, and the Geometric or formal Garden.

Pinus cembra
Cupressus Lawsoniana
„ „ erecta viridis
* „ sempervirens
Retinospora leptoclada
Biota orientalis elegantissima
Libocedrus decurrens
Juniperus hibernica
„ suecica
Thuia plicata variegata
Juniperus drupacea
„ excelsa stricta
Juniperus neaborensis
„ thurifera
Taxus adpressa erecta
„ baccata aurea
„ „ erecta
„ „ elegantissima
„ „ fastigiata
„ „ „ argentea
„ „ „ aurea
Cephalotaxus pedunculata fastigiata.

Select coniferous small trees and shrubs of dense growth and regular outline, suitable for the Lawn, the Terrace, and Geometric Garden, as single or isolated specimens.

Abies excelsa Clanbrasiliana
„ „ pumila
„ „ pygmæa
Cryptomeria elegans nana
Cupressus Lawsoniana albo-variegata
„ „ lutea
„ „ nana
„ nutkaënsis compacta
Retinospora obtusa compacta
„ ericoides
Retinospora plumosa
„ „ albo-picta
„ „ argentea
„ „ aurea
„ tetragona aurea
Biota orientalis aurea
Thuia occidentalis Hoveyi
Juniperus communis compressa
„ chinensis aurea
„ „ albo-variegata
„ japonica aureo-variegata.

Coniferous shrubs of dwarf bushy habit and bright coloured foliage, suitable for permanent and winter bedding.

Abies excelsa pumila
" " pygmæa
Cryptomeria elegans nana
Cupressus Lawsoniana alba spica
" " albo-variegata
" " argentea
" " aureo-variegata
" " erecta viridis
" " lutea
" " nana glauca
" nutkaënsis compacta
" thyoides variegata
Retinospora ericoides
" leptoclada
" obtusa aurea nana
" " pygmæa
Retinospora plumosa
" " albo-picta
" " argentea
" " aurea
" tetragona aurea
" squarrosa
Biota orientalis aurea
" " elegantissima
Thuia occidentalis lutea
Thuiopsis dolabrata
" " variegata
Juniperus sabina variegata
" " tamariscifolia
" chinensis aurea
" " albo-variegata
" japonica
" " aureo-variegata
" excelsa stricta
Taxus baccata aurea
" " elegantissima.

Coniferous shrubs of dwarf or prostrate habit, suitable for the Rock Garden.

Abies excelsa Clanbrasiliana
" " pygmæa
" canadensis parvifolia
Cryptomeria elegans nana
" japonica nana
Cupressus Lawsoniana nana
" " " glauca
" " albo-variegata
" nutkaënsis compacta
Retinospora ericoides
" filifera
" leptoclada
" lycopodoides
" obtusa aurea nana
" pygmæa
" plumosa albo-picta
" " argentea
" " aurea
" tetragona aurea
" squarrosa
" " dubia
Biota orientalis aurea
" " elegantissima
Thuia occidentalis
" " Elwangeriana
" plicata dumosa
Thuiopsis lætevirens
Juniperus canadensis
" communis
" " compressa
" hemisphærica
" procumbens
" Sabina
" " variegata
" tamariscifolia
" squamata
" japonica
" " aurea
" " aureo-variegata
Taxus baccata aurea
" " Dovastonii
" " elegantissima
" " ericoides.

A few Coniferous trees, chiefly North American, grow naturally on the banks of streams, lakes, &c., and some even in swampy places. All such are available for planting in proximity to ornamental water, lake, or river. Of such are the following :—

Abies Menziesii
„ nigra
„ canadensis
Larix microsperma
Pinus rigida
Taxodium distichum
„ pendulum
Cupressus thyoides
„ „ variegata
Retinospora leptoclada
Thuia Lobbi (gigantea)
Thuia occidentalis
„ „ pendula
„ „ variegata
„ „ Vervaeneana
Juniperus virginiana
„ „ aureo-variegata
„ „ dumosa
„ „ pendula
„ recurva
„ „ densa.

The following Coniferous trees and shrubs will grow on chalk soil :—

Abies excelsa
„ canadensis
Cedrus atlantica
* „ deodara
Abies magnifica
„ nobilis
„ Nordmanniana
„ pinsapo
Pinus austriaca
„ Laricio
„ pinaster
„ sylvestris
„ excelsa
* „ insignis
Larix europea
„ leptolepis
Wellingtonia gigantea
Sequoia sempervirens
Cupressus Lawsoniana
„ „ erecta viridis
*Cupressus macrocarpa
„ nutkaënsis
Biota orientalis
„ „ aurea
Thuia Lobbi
„ occidentalis
„ plicata
„ „ Wareana
Juniperus communis
„ „ hibernica
„ Sabina
„ virginiana
„ chinensis
Taxus baccata
„ „ aurea
„ „ elegantissima
„ „ fastigiata
Salisburia adiantifolia.

The foregoing list, with the exception of four or five of the included names, is taken from an article in the *Gardeners' Chronicle* for November 6th, 1875, communicated by James Salter, Esq., F.R.S., in which he enumerates the kinds of Coniferous and other trees he found on trial to flourish on his own chalk land. Mr. Salter remarks that "among the larger Conifers that thrive in chalk soil, the common

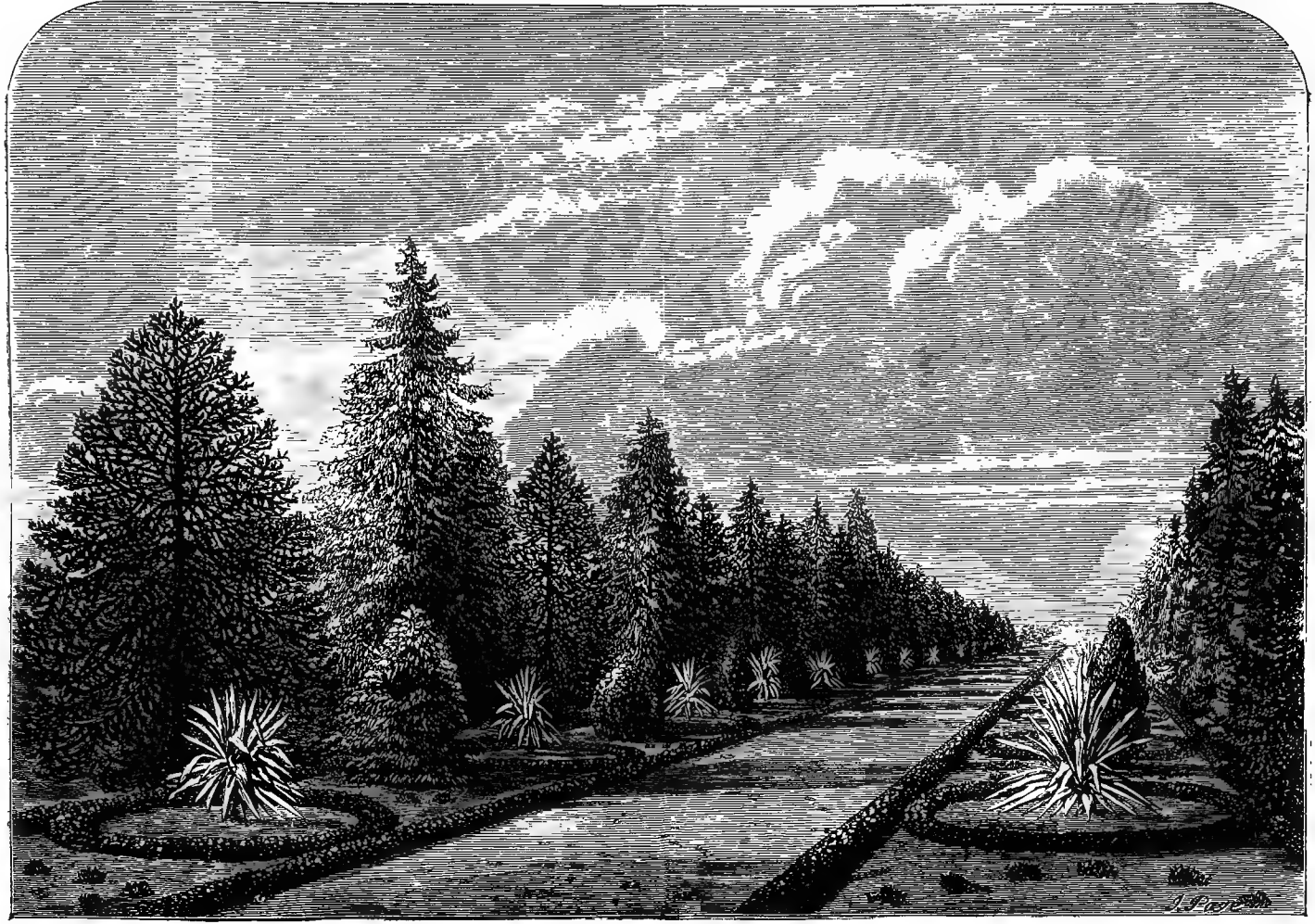
Spruce ranks first, scarcely one dies, and in a short time the young trees grow with great vigour and rapidity. *Pinus Laricio* comes next, few die, and they grow with singular rapidity and strength. *P. austriaca* grows well after the second year, but a larger proportion die than with *P. Laricio*. The Scotch Fir grows well, but some die. These four species are the best of the common sorts for block planting, and may be thoroughly depended on. *Cedrus atlantica* and *C. deodara* do very well, but the latter is apt to become pale and yellowish where the soil is superficial. The colour of *Abies Nordmanniana* degenerates, but *A. pinsapo* retains its rich deep green, while its growth is more free and healthy. *Thuia Lobbi* and *Cupressus nutkaënsis* grow most luxuriantly, and the *Wellingtonia* is a complete success."

IV.—AVENUES.

Avenues for approaches and carriage drives, and for vistas may be formed with any of the larger Coniferous trees, but it is evident from the form and outline assumed by them during the best period of their growth, and also when they have attained their maturity, that there are some incomparably superior to others in producing stately and picturesque effect. Of such the following are among the best that can be selected:—

Wellingtonia gigantea
*Cedrus deodara
Araucaria imbricata
Abies nobilis
,, Nordmanniana
,, pinsapo
,, concolor (lasiocarpa)
Cedrus atlantica
,, Libani
Pinus austriaca
,, pyrenaica
Pinus excelsa
,, Strobus
,, monticola
Abies brachyphylla
,, Douglasii
,, orientalis
Thuia Lobbi (gigantea)
Thuiopsis dolabrata
Cupressus Lawsoniana
,, nutkaënsis
Libocedrus decurrens

The above-named trees are symmetrical in habit, hardy in constitution, and clothed with foliage of a distinct and pleasing colour. To secure uniformity of growth throughout an avenue planted with any one of these kinds, *seedling plants of the same age* should be selected and the soil should be of the same constituents and of equal drainage. If naturally good and well drained, it will be sufficient to break up the soil to a good depth before setting the young plants; but if it is chiefly composed of sand or gravel, a good supply of fibrous loam, mixed



The Wellingtonia and Araucaria Avenue at Coombe Wood.

with thoroughly decomposed vegetable refuse, should be used, in order that the young trees may get well established. An avenue of striking effect may be formed by alternating the Wellingtonia with the Araucaria, of which there is a good example at our Coombe Wood Nursery. (*See* Woodcut). The Araucaria may be also alternated with the Deodar with fine effect. The Cedar of Lebanon is open to objection on account of its sombre aspect and want of uniformity in outline; it is also of comparatively slow growth, so that a considerable period of time is required for it to become effective. The Mount Atlas Cedar may be advantageously substituted for it on chalk soils and in exposed situations. Very formal avenues may be planted with *Thuia Lobbi*, *Cupressus Lawsoniana*, *C. nutkaënsis*, and *Libocedrus decurrens*, all of which require much less room than the trees of the Fir and Pine tribe, and may, therefore, be employed where the space is limited.

V.—EVERGREEN HEDGES.

The Coniferæ include some of the best subjects for the formation of evergreen hedges that are intended for ornamental as well as for useful purposes. Very handsome hedges can be made with the following kinds, all of which have been proved to withstand for years without injury, the severest tests of our climate, *Cedrus deodara* and *Retinospora obtusa* alone requiring a situation not exposed to the north-east; and the latter, as well as the Thuias, preferring a moist soil:—

Taxus baccata	Cupressus Lawsoniana
Cedrus deodara	„ nutkaënsis
Thuia Lobbi	Juniperus chinensis
Biota orientalis	„ virginiana
Retinospora obtusa	„ „ argentea
Thuia occidentalis	Abies excelsa

The common Yew forms the strongest, the most durable, and the most impervious hedge of any Coniferous tree. For protective purposes, the Yew hedge is unsurpassed, and if less ornamental than hedges formed with the other plants named above, its deficiency in this respect is more than counterbalanced by its utility. To form a Yew hedge of medium height, that is to say from 6 to 8 feet, the plants should be set at a distance of 12 or more inches apart, according to the age and size of the plants used.

The Deodar forms a highly ornamental hedge. The annual cutting to which it must be subjected to keep it within the prescribed width,

causes it to produce numberless pendulous shoots with very pleasing effect. For a hedge of from 8 to 10 or 12 feet high for a short length in a conspicuous position, the Deodar will be found to be one of the best plants that can be selected. To form a Deodar hedge, plants of almost any age and size may be selected that have been kept in condition for removal by frequent transplanting.

Thuia Lobbi forms a strong dense hedge in a comparatively short period. It is one of the best of plants for an ornamental hedge on account of its bright green colour, which it retains through the winter months; and for a protective hedge, it is surpassed only in a small degree by the Yew.

Biota orientalis forms an excellent hedge of low or medium height, from 8 feet and upwards in good soils. It may be substituted for either of the Thuias or *Retinospora obtusa* where a narrow hedge is required.

Retinospora obtusa forms a handsome and compact hedge in a moist retentive soil and sheltered situation. Its rich fulvous green foliage supplies a pleasing contrast to that of other plants.

Thuia occidentalis is scarcely inferior to *T. Lobbi* as a hedge-forming Conifer in retentive soils. It should not be selected for a high and exposed situation, nor for dry sandy soils, where it becomes thin and unfurnished.

Cupressus Lawsoniana should be planted in quite a young state to form a compact hedge of small dimensions. It is a cheap, and on the whole, a useful substitute for the more expensive kinds.

Cupressus nutkaënsis forms a compact hedge, which is rendered very ornamental by the light feathery pendulous terminal branchlets. It is slower in growth than *C. Lawsoniana*, and for distinctness the glaucous variety should be preferred to the common form.

Juniperus chinensis, *J. virginiana*, and its variety *J. virginiana argentea*, form good hedges; the light glaucous foliage of the last-named renders it very effective for contrast. These and the six preceding kinds should be planted at intervals not greater than from 15 to 18 inches, according to the age and size of the plants selected.

Abies excelsa is used as a hedge-forming plant in several parts of Europe where other Coniferous trees are not available. It forms a strong and impervious fence, and bears close cutting. Planted at intervals of from 2 to 2½ feet, according to the size of the plants, it soon forms a compact hedge of any height, but it is surpassed in all respects by the common Yew.

All hedges and partitions made with living plants require periodical cutting and clipping to keep them dense, strong, neat, and within prescribed limits. Hedges made with deciduous and evergreen plants, not Coniferous, are usually trimmed in mid-season while growing, but in the case of Conifers, it will be remembered that during the

growing season, the circulation of the sap is exceedingly active, and that if much cut at that time, they are liable to suffer from excessive "bleeding." From this important fact may be deduced the *rationale* of the after treatment of Coniferous hedges when established, viz., that they should be cut only when the sap is comparatively quiescent, either in autumn when the growth of the season is completed, or early in spring before the commencement of growth. It is the growth of the current season that chiefly gives beauty to the Coniferous hedge, and if that is cut off in the full vigour of its formation the effect is marred, and the health of the plants is liable to be impaired.

VI.—BELTS AND SCREENS.

No trees are better adapted for belts and screens planted for protective and other purposes than the common hardy Coniferæ. Their rapid and dense growth render them the best of "nurses" for more tender kinds, especially during "infancy;" they afford the most effectual protection from north, north-east, and easterly winds; they are the most suitable for shutting out of view an incongruous feature in the landscape, or for forming some bold or distinct distant addition to it; also for hiding unsightly buildings, and for seclusion. The following list includes all the common kinds available for Belts and Screens required for such purposes:—

Abies excelsa
,, nigra
,, Nordmanniana
,, pectinata
,, canadensis
,, Douglasii
Cedrus atlantica
Larix europea
Pinus austriaca
,, Laricio
,, Pinaster
,, sylvestris
Pinus Strobus
,, excelsa
,, Cembra
Cupressus Lawsoniana
,, nutkaënsis
,, thyoides
Thuia Lobbi
,, occidentalis
Biota orientalis
Juniperus virginiana
,, chinensis
Taxus baccata

In forming mixed belts with any of the above, the Thuias, Lawson's Cypress, the Nootka Sound Cypress, and the Junipers, if used, are best planted on the outside, where they will retain their lower branches and dense habit for a longer period. The Hemlock Spruce should only be used where it has been proved to grow rapidly. *Pinus pinaster*, *P. Laricio*, and *P. densiflora* are excellent seaside Pines; *P. insignis*,

Sequoia sempervirens, and *Cupressus macrocarpa* (not included in the above list), also attain their finest proportions within the influence of the sea air, but require a sheltered south aspect and a moist loamy soil. The common Yew, Spruce Fir, and the Larch Pine are the best for chalk soils in an exposed situation. *P. Strobus* and *P. excelsa* are dense on heavy soils; *P. rigida*, *Abies nigra*, *Thuia occidentalis*, and *Cupressus thyoides* are suitable for wet or moist places only.

VII.—CONSERVATORY AND WINTER GARDEN.

Coniferous trees and shrubs do not meet with much favour as decorative plants for the Conservatory, except a few species, limited chiefly to one genus (Araucaria), all of which are of remarkably formal but elegant habit, and are densely furnished with bright green foliage. To these may be added a few others with distinct foliage that are too tender for out-door culture. The following list includes all the tender Araucarias cultivated for conservatory decoration, with a few other kinds occasionally used for the same purpose:—

Araucaria excelsa
" " glauca
" " robusta and other varieties
" Cunninghami
" " glauca
" Rulei
" " elegans
" Cookii

Araucaria Bidwilli
" brasiliensis
Callitris quadrivalvis
Libocedrus Doniana
Dacrydium elatum
" araucarioides
Agathis robusta
" australis
" Moorei

VIII.—MEMORIAL TREES.

The great age and size attained by many of the Coniferæ, together with their majestic aspect, render them especially appropriate for perpetuating the memory of events and circumstances. The following list includes the most important trees remarkable for longevity, stately aspect, and perfect hardiness in our climate. None of them, however, will fulfil the object of a Memorial Tree in the immediate vicinity of large towns. The antipathy of the whole Order to the influence of smoke is irremediable.

Cedrus Libani
„ deodara
„ atlantica
Wellingtonia gigantea
Abies nobilis
„ Nordmanniana
„ concolor
„ Douglasii
„ Albertiana
„ magnifica
„ pinsapo
„ cephalonica
Abies grandis
„ brachyphylla
Araucaria imbricata
Pinus Lambertiana
„ excelsa
„ monticola
Thuia Lobbi
Thuiopsis dolabrata
Libocedrus decurrens
Taxodium distichum
Taxus baccata
Salisburia adiantifolia.

As an ancestral tree, as a living memento of some important family event, the Cedar of Lebanon is one of the most appropriate on account of the many interesting associations connected with it, and for its own characteristic form and majestic grandeur. To fulfil, in a befitting manner, the purpose of a Memorial Tree, it is indispensable that a sufficient space should be allowed to enable it to attain its fine proportions without impediment; when this is not provided for the tree assumes the appearance of old age before it reaches it. The Deodar has associations that entitle it to respect apart from its own intrinsic beauty; as an ancestral tree, it may properly be substituted for the Cedar of Lebanon where sufficient space is not available for that grand tree. The Atlantic Cedar may be advantageously substituted for either of the preceding in an exposed situation. The Wellingtonia, bearing an historical name, may properly be selected to commemorate national or public events. It is also an appropriate tree to plant as a souvenir of a visit by royal and distinguished personages. *Abies Albertiana*, which bears a royal name, and the noble Fir *A. nobilis*, are also magnificent trees for commemorating royal and distinguished visits; but the latter should not be selected for a dry sandy soil. The cheerful colour of *A. Nordmanniana* and the light aspect of *Ginkgo biloba*, for which *Taxodium distichum* may be substituted in retentive soils, are fitting subjects to commemorate the foundation or opening of useful or charitable institutions. *Pinus Lambertiana* owes its name to one of the most enlightened and munificent patrons of science and art in England, particularly botany and horticulture, in the first half of the present century; *Abies Douglasii* and *Thuia Lobbi* bear the names of the most intrepid and successful discoverers of new and beautiful trees and plants in the same period; all of these, therefore, are suitable Memorial Trees for any object in connection with botany and horticulture.

Abies brachyphylla is one of the hardiest of its tribe, and may be selected for a Memorial Tree for spots where other Conifers would be liable to injury from cold piercing winds. *A. cephalonica* should only

be planted as a Memorial Tree on elevated ground. *A. pinsapo* may be selected for a chalky and *A. Douglasii* for a loamy soil.

To enable the young specimens selected for Memorial Trees to get well established, especial attention should be given to the preparation of the soil in the manner pointed out in page 328. The trees should also be protected from the depredations of cattle, &c., by an iron wire or wooden fence, if exposed to injury from those causes.

IX.—CEMETERIES AND BURIAL GROUNDS.

The following Coniferous trees and shrubs are recommended as suitable objects for the improvement of Cemeteries and Burial Grounds. Many of them present aspects especially in harmony with the associations connected with these places, and all of them are hardy and thrive generally in any ordinary soil. Those marked (*) are suitable for avenues, and those (†) for graves.

†Abies excelsa Clanbrasiliana
,, ,, elegans
,, ,, Finedonensis
,, ,, inverta
,, ,, pumila
,, ,, pygmæa
,, orientalis
,, canadensis
*Cedrus Libani
* ,, atlantica
* ,, deodora
*Pinus austriaca
,, Cembra
*Araucaria imbricata
†Cupressus Lawsoniana albo-variegata
† ,, ,, erecta viridis
† ,, ,, nana
† ,, ,, nana glauca
,, nutkaënsis
† ,, ,, compacta
,, sempervirens
†Retinospora filifera
,, lycopodioides
,, obtusa
,, plumosa
† ,, ,, aurea
† ,, ,, argentea
†Retinospora ericoides
† ,, leptoclada.
Biota orientalis
† ,, ,, aurea
† ,, ,, elegantissima
,, ,, pendula
Thuia occidentalis
† ,, ,, Elwangeriana
,, ,, pendula
† ,, plicata dumosa
,, Standishii
*Libocedrus decurrens
Juniperus communis
,, ,, cracovia
,, ,, suecica
,, rigida
,, virginiana
,, ,, pendula
,, chinensis
† ,, ,, aurea
Taxus adpressa
,, baccata
† ,, ,, Dovastonii
,, ,, erecta
† ,, ,, fastigiata
,, ,, fructu-lutea
†Cephalotaxus pedunculata fastigiata

XI.—CONIFEROUS TREES VALUABLE FOR THEIR TIMBER.

The great value of Coniferous timber for constructive work has been frequently adverted to in the preceding pages. The following Synoptic Table contains the names of the principal Coniferous trees felled for their timber, either for use in their native countries, or for exportation. Many other Coniferous trees, not included in the table, are known to yield more or less useful timber, but owing to their present inaccessibility, or the presence of other kinds of superior quality, or from some other cause, their wood is not yet much employed for economic purposes.

There is much confusion in the commercial nomenclature of Coniferous timber, so that it is frequently impossible for those not engaged in the business to identify the tree referred to under the commercial name of the timber it produces. Thus "fir" and "pine" are used indiscriminately for Abies and Pinus; and such terms as white pine, yellow pine, red pine, &c., are not unfrequently applied to timber produced by the same species but brought from different ports

The timber of some of the *Agathis (Dammara)*, *Podocarps*, and *Darydiums* is also called "pine" in Australia and New Zealand.

Scientific Name.	Popular Name.	Country or Region where used or exported.	Remarks.
ABIES ALBA	The White Spruce...	British North America	Timber inferior, and used chiefly for certain purposes in shipbuilding.
ALCOQUIANA ...	... ...	Japan	
CANADENSIS ...	The Hemlock Fir ...	North America ...	Timber inferior.
DOUGLASII ...	The Douglas Fir ...	N.W. America ...	The Red Fir of the settlers in British Columbia.
EXCELSA ...	The Spruce Fir ...	Northern Europe ...	Commonly known among builders as "Baltic Fir." It supplies the White Deal of commerce.
ENGELMANNI ...	Engelmann's Fir ...	Colorado and New Mexico	
FIRMA	... ...	Japan	Mo-mi of the Japanese.

Scientific Name.	Popular Name.	Country or Region where used or exported.	Remarks.
ABIES GRANDIS ...	The tall Fir ...	Oregon & California	The White Fir of the settlers as distinguished from the Red Fir, *Abies Douglasii.*
MENZIESII ...	Menzies' Fir ...	N.W. America ...	Timber light, straight grained, and very valuable.
NIGRA	The Black Fir ...	British America and New England States	The American White Pine of commerce.
NOBILIS ...	The noble Fir ...	California & Oregon	
OBOVATA ...	The Siberian Spruce	Northern Asia ...	The most important timber tree in northern Asia.
ORIENTALIS ...	The eastern Fir ...	Armenia	
PECTINATA ...	The common Silver Fir	Central Europe	
SMITHIANA ...	The Indian Spruce	Himalayas	Morinda and Khutrow of the natives.
ARAUCARIA IMBRICATA	The Chili Pine ...	Southern Chili ...	Pehuen of the aborigines.
BIDWILLI ...	Bidwill's Araucaria	Queensland, Australia	The Bunya-bunya.
CUNNINGHAMI	The Moreton Bay Pine	,, ,,	One of the most useful timber trees of the colony.
CEDRUS DEODARA ...	The Deodar... ...	Western Himalayas	The most important timber tree in north-west India.
CRYPTOMERIA JAPONICA	The Japanese Cedar	Japan	Sung-i of the Japanese, and the most useful timber tree of Japan.
CUPRESSUS LAWSONIANA	Lawson's Cypress ...	North California	
NUTKAËNSIS ...	The Nootka Sound Cypress	British Columbia and Oregon	The Yellow Cypress of the settlers.
SEMPERVIRENS	The common Cypress	South of Europe and the Levant	One of the most durable woods known.
DACRYDIUM CUPRESSINUM	The New Zealand Spruce	New Zealand ...	Timber valuable for building and constructive purposes generally.

Scientific Name.	Popular Name.	Country or Region where used or exported.	Remarks.
DACRYDIUM FRANKLINII ...	The Huon Pine ...	Tasmania	One of the most important timber trees of the colony.
DAMMARA (*Agathis*) AUSTRALIS	The Kauri or Cowrie Pine	New Zealand, Northern Island	A very useful timber tree.
JUNIPERUS BERMUDIANA	The Bermuda Juniper	Bermuda Islands ...	Wood formerly much used in the manufacture of "Cedar" pencils.
EXCELSA ...	The tall Juniper ...	Western and central Asia	Much used in parts of Afghanistan, where other timber is scarce.
VIRGINIANA ...	The Virginian Red Cedar	North America, Eastern States	Wood substituted for that of *Juniperus Bermudiana*.
LARIX EUROPÆA ...	The common Larch	Central Europe	
MICROCARPA ...	The American or Black Larch	Canada and New England States	The Tamarack of the Colonists.
LIBOCEDRUS CHILENSIS	The Chilian Arbor Vitæ	Chili	The "Cipres," or Cypress of the Chilians.
TETRAGONA ...	The Alerze	Chili and Patagonia	The most valuable timber tree of the country.
DONIANA ...	Don's Libocedrus ...	New Zealand ...	The Kawaka. Wood used for indoor carpentry.
PINUS AUSTRIACA ...	The Austrian Pine	Central Europe	
DENSIFLORA ...	The Japanese Pine	Japan	Matsu. The common Pine of the country.
LARICIO ...	The Larch Pine ...	Southern Europe	
PINASTER ...	The Cluster Pine ...	,, ,,	Timber soft, coarse in grain, and of little value.
MITIS	The soft-leaved Pine	New England States	American Yellow Pine of commerce.
RESINOSA ...	The Canadian Pine	Canada	Red Pine of commerce. The best of the Canadian Pines.
SYLVESTRIS ...	The Scotch or Wild Pine	North of Europe ...	Commercially known as Russian Pine, Memel Fir, Baltic Yellow Deal, &c.

Scientific Name.	Popular Name.	Country or Region where used or exported.	Remarks.
PINUS AUSTRALIS ...	The long-leaved Pitch Pine	The Atlantic littoral from Carolina to Florida	Red or Pitch Pine of the Americans. Wood superior to that of any other American Pine.
PONDEROSA ...	The Western Pitch Pine	California & Oregon	The Yellow Pine of Western North America.
RIGIDA... ...	The Pitch Pine ...	United States	
BALFOURIANA	The Fox-tail Pine ...	N. W. America ...	Timber much used in the mining works in Nevada, Colorado, &c.
CEMBRA ...	The Swiss Stone Pine	Central Europe and Siberia	Cembra Pine of commerce.
FLEXILIS	The White Pine ...	Rocky Mountains	
LAMBERTIANA	The Sugar Pine ...	California	
STROBUS ...	The Weymouth Pine	North America, eastern portion	Canadian White Pine, but sometimes American Yellow Pine of British markets.
PODOCARPUS CUPRESSINUS	The Cypress-like Podocarp	Java...	One of the best timber trees of the island.
TOTARA ...	The Totara Pine ...	New Zealand ...	One of the best timber trees in the colony.
RETINOSPORA OBTUSA	The Japanese Cypress	Japan	Hi-no-ki of the Japanese. Timber very fine and durable.
PISIFERA ...	... ...	,, ...	Sawara of the Japanese. Timber not so good as that of *Retinospora obtusa*.
SALISBURIA ADIANTIFOLIA	The Maiden-Hair Tree	China and Japan ...	The Ginkgo of the Chinese. It-cho of the Japanese.
SEQUOIA SEMPERVIRENS	The Californian Redwood	California	Redwood is more used in California than any other timber.
TAXUS BACCATA ...	The common Yew...	Europe	
TAXODIUM DISTICHUM	The deciduous Cypress	Southern Atlantic States of North America	Bald Cypress, or Black Cypress of the Americans.

Scientific Name.	Popular Name.	Country or Region where used or exported.	Remarks.
THUIA LOBBI (GIGANTEA)	Lobb's Arbor Vitæ...	California & Oregon	Timber called "Cedar" by builders, &c., in California.
OCCIDENTALIS...	The American Arbor Vitæ	Canada and New England States	The wood is called "Cedar" in Canada.
THUIOPSIS DOLABRATA	The Japanese Arbor Vitæ	Japan	Asu-naro of the Japanese. Wood yellow and durable. Much used for masts of junks, &c.

Scotch, Weymouth, and Pitch Pine, and Norway and American Spruce Fir constitute the bulk of the Coniferous timber imported into Great Britain. The same description of timber is also more largely used than any other in the countries and regions in which the trees that produce it, are the preponderating members of the forest. The Corsican Pine, Red Pine, Larch, Californian Redwood, Kauri Pine, and Sungi (Cryptomeria) are used in enormous quantities in their respective native countries, in consequence of the accessibility of the forests in which they form the predominating element, and the proximity of a dense or rapidly increasing population. The timber yielded by the trees above enumerated, probably exceeds by many times over that obtained from all the other Coniferous trees taken together.

The consumption of Coniferous timber is proceeding at a rate that would exceed belief, were it not attested by reliable statistics. Our space does not permit us to enter fully into the details that have been published from time to time, but the following instances will suffice to show the importance of the subject.

"A rough estimate of the value of the Norwegian forests, has put them down at about £22,000,000; and, according to the last census, 13,638 persons were occupied in the wood cutting and rafting. The exportation of timber from Norway has doubled within the last quarter of a century; the average annual rate of exportation between 1870-74 being about 84,510,000 cubic feet, of which Great Britain took about 50,000,000 cubic feet."—(*J. of Soc. of Arts*, Feb. 6, 1880).

"From the New York census returns for 1865, we learn that the amount of Black Spruce lumber produced in the preceding year was 71,000,000 feet. If we suppose 5,000 feet to be the product of an

acre, it would require more than 14,000 acres to furnish this quantity. As these figures represent the quantity of Black Spruce timber felled in a portion of the United States only, the extent of Spruce forest annually cleared, both in the United States and in British America, must be set down at a much higher figure."—(From *The Garden*, vol. ix., p. 481).

"The area of the Redwood forests of California was estimated, five years ago, at 500,000 acres. The consumption of Redwood timber in 1874 amounted to upwards of 600,000,000 feet, or 50,000,000 feet in excess of the previous year. At this rate it is estimated that, in less than a quarter of a century, the whole of the Redwood forests will have been felled."—(From the *Gardeners' Chronicle*, Oct. 23, 1875).

"No less than 70,000,000 cubic feet of the Kauri Pine of New Zealand *(Agathis australis)* was cut down and sawn for home use and for exportation in the province of Auckland alone, during the year 1878. The Kauri Pine is a tree of rapid growth, and produces timber of great economic value; but at this rate of consumption, it is evident that the native forests must become extinct in the course of a few years."—(Capt. C. Walker, *Report on New Zealand Forests*).

XII.—COLLECTIONS OF CONES AT CHELSEA.

Cones of different species gathered from the trees growing in their native countries by our collectors, and sent home by them from time to time, are preserved in the museum attached to the Royal Exotic Nursery at Chelsea. To these have been added many other kinds gathered from trees in cultivation in this country. From this collection most of the drawings and descriptions of the cones given in the preceding pages were chiefly taken. The cones can always be inspected by visitors to the Nursery.

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*** *The names in italics are synonyms still in common use.*

ILLUSTRATIONS.

ILLUSTRATIONS—continued.